MAY 1957

TOOLING & PRODUCTION Magazine

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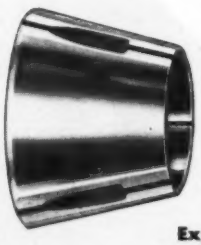
INSTANT internal and external chucking Without Stopping Spindle!*

*For bar or expanding arbor work

SUTTON Levermatic COLLET CHUCK

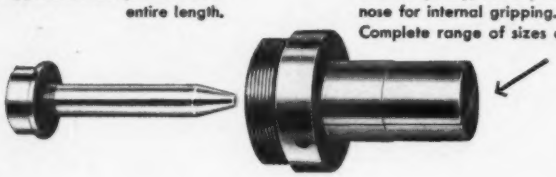
Boost production on any of your machines with this revolutionary precision chuck! Easy to use. A simple finger-tip adjustment determines exact amount of pressure to set and maintain any type of work—powerful grip for heavy cuts of tough steel, or a firm but gentle grip for thin tubing. Takes maximum bar stock capacity of spindle. Produces no heat or friction.

Likewise, the Levermatic can be used effectively as a non-rotating work-holding device on milling machines, gear hobbers, grinders and many types of special machinery. Available in three sizes —1″, 1½″ and 2″ capacities.



Co-netic Collet →
Separate sections allow full floating, self-aligning action in each jaw. Applies uniform pressure over entire length.

Expanding Arbor
Mounts quickly, directly to spindle nose for internal gripping. Complete range of sizes available.



RUNS AS TRUE AS THE SPINDLE

Sutton Tool Company

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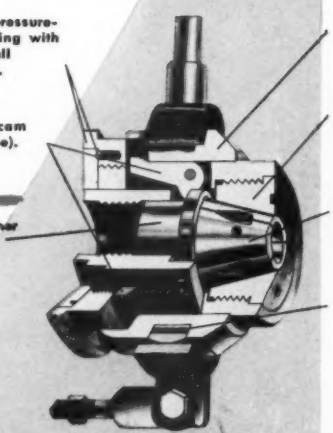
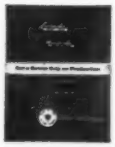

Selective pressure-adjusting ring with positive ball detent lock.
Hardened cam levers (three).
Collet pusher sleeve.
Positive cam closing collar.
Precision ground collet closing ring.
The new Co-netic Collet—new parallel grip design.
Self-lubricating bronze yoke shoe.

Send For Catalog →
Shows construction, specifications and many standard and special applications.



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"the reamer specialists"
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CHICOPEE, MASS.
CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

MAY 1957
VOL. XXIII—No. 2
GEORGE J. HUEBNER, Founder

Personally speaking

Dear T&P Reader:

Since the "average" age of a T&P reader is 44 years I guess the "average" reader remembers the old LIBERTY Magazine that used to sell for a nickel and that proudly notified the reader just exactly how long it would take him to read each article. They would write under the headline, "Reading Time — 12 min. 20 sec." Remember?

I always wondered if they had a vice-president in charge of reading time. Now, I know that they structured a scale based on certain variables such as "average" reading speed, polysyllables, number of words per sentence, etc. Of course, there's another way to go about this. They might have gone to a representative sample of their readers with the same article and averaged out the reading time. Then they could have created a scale to determine just how many words could be read in a minute or a second.

You might wonder why, in an industry magazine like T&P, I am talking about reading speed. The reason is that I want you to know how seriously our editors consider this matter.

Without sacrificing thoroughness and value for you they do everything possible to make the articles in T&P clear and fast reading. They know your time is limited for reading, just as it is for just about everything else you do during a busy day. So great care is given to each article so that it can communicate the idea or concept to you — quickly but thoroughly.

The placement of pictures and the writing of captions, the use of diagrams and charts, and a host of other considerations are made with this in mind.

Of course, our editors must always keep in mind the fact that "you" are collectively the best informed group of experts on the technical aspects of tooling and production of metal parts and products. They cannot let brevity become the sole criterion of value and interest. Clarity of communication is really the end result that makes T&P both valuable and interesting.

At least, that's what our research tells us that "you", our readers, think about T & P.

Cordially yours,

Ray L. Huebner

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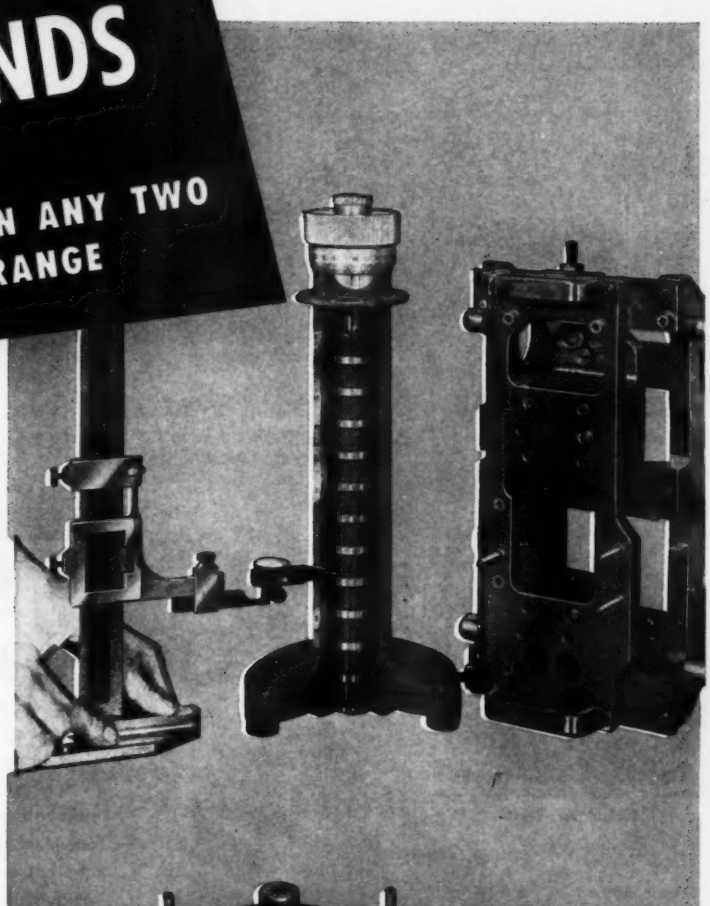
SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



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SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

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With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

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CIRCLE INFORM-A-GRAM KEY NO. 5

RED RING HARD GEAR HONING

PRODUCES QUIET GEARS

Nicked Gear Tooth

Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

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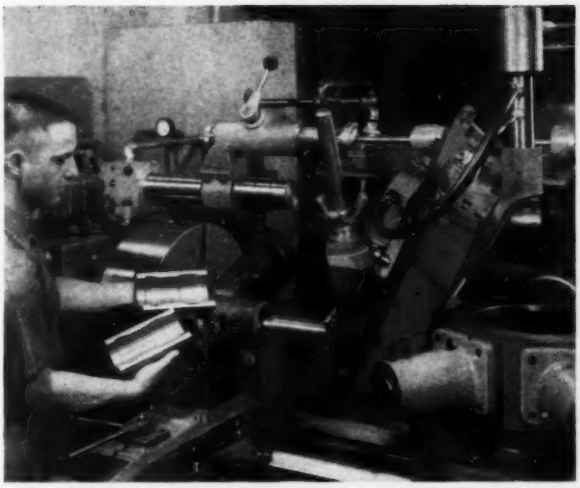
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

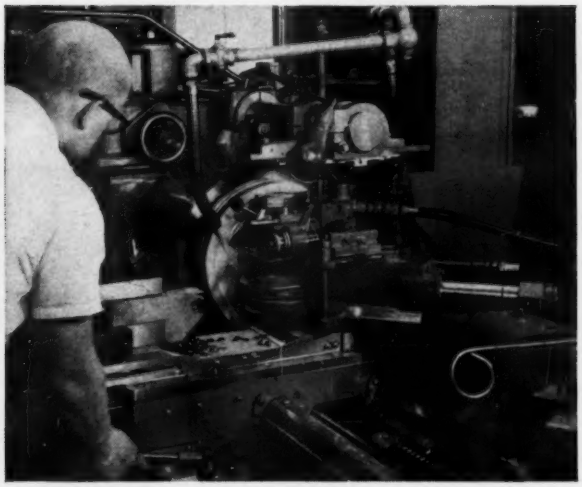
CIRCLE INFORM-A-GRAM KEY NO. 6

Available on Warner & Swasey 3-A and 4-A Saddle Type Turret Lathes.



NEW WARNER & SWASEY HEXAGON TURRET CONTOURING SLIDE TOOLS—Exclusively designed for contour boring work.

Available on No. 5 Ram Type and 2-A, 3-A and 4-A Saddle Type Turret Lathes.



WARNER & SWASEY CROSS SLIDE CONTOUR ATTACHMENTS—The only turret lathe contour attachments that give you both *contour turning* and *cross center contour facing* in one unit.

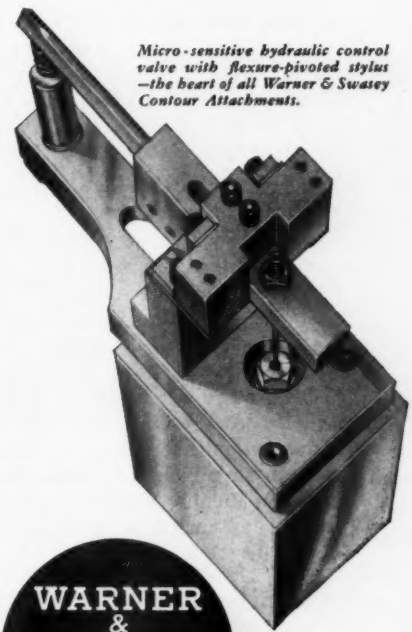
There is a difference in contour attachments

ON WARNER & SWASEYS, the difference is BASIC CONTROL. Translating the touch of the tracer stylus on the template to a precise, powerful cutter feed on the workpiece is the job of the "Micro-Sensitive" control arrangement used on all Warner & Swasey contour devices. A unique flexure-pivoted stylus and an instrument-quality hydraulic control valve provide unmatched sensitivity, fast response, and accuracy in the action of the contour units.

These controls eliminate lost motion, assure precise return of the cutter for exact machining of identical diameters that are separated like this:

Ninety-degree faces like this are made flat and square, properly located longitudinally on the part without need for compensations in the template form—template and part contours are exact duplicates.

Exceptional accuracy of these controls is matched only by Warner & Swasey's dependability and rugged construction. Individual laboratory inspection assures the quality of each "Micro-Sensitive" control valve.



Micro-sensitive hydraulic control valve with flexure-pivoted stylus —the heart of all Warner & Swasey Contour Attachments.

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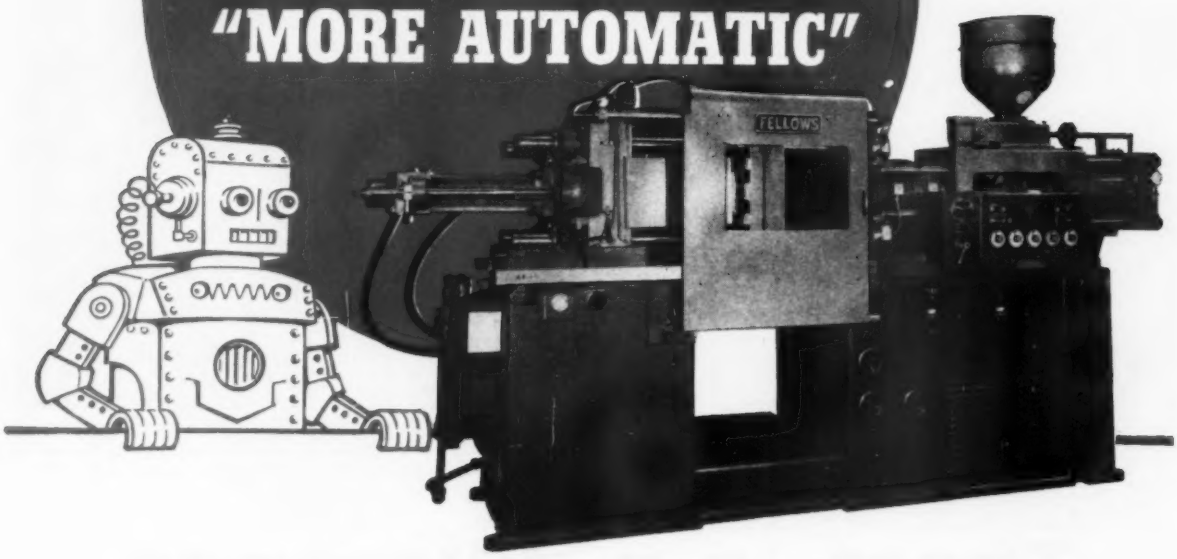
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

CIRCLE INFORM-A-GRAM KEY NO. 7

How you can make it "MORE AUTOMATIC"



Attachments Make Fellows "6-200" FULL-AUTOMATIC on Any Job!

Automatic molding pays off in increased production, improved quality of product and lower production costs. The Fellows 6-200 was designed for automatic molding — either partial or full. Its basic design was so planned that the attachments necessary to accomplish the desired degree of automatic operation can easily be incorporated in the machine.

Solving production problems in the molding of containers, closures, cams and a wide variety of consumer and industrial products having internal and external threads, undercuts and side cores brought about the development of a range of attachments which can readily be added to the Fellows 6-200 according to your job requirements. Look over the list — ask for further information on the machine. See for yourself how you can save money by using a Fellows 6-200 Injection Molding Machine, the fastest and most versatile automatic in its capacity range.

Versatile *Fellows Plans* provide convenient short or long-term financing, let your machine pay for itself out of extra earnings. Ask your Fellows representative for the facts. Just get in touch with any Fellows office.

OPTIONAL SPECIAL ATTACHMENTS

- Prepack and pre-position
- Low pressure mold closing protection
- Dual hydraulic knock-out mechanism
- Front knock-out device
- Press stroke interruption and control
- Press speed control
- Air sweeps for article and runner removal
- Multi-nozzle set-ups
- Extra power packs for high-speed injection
- Power take-off for side-action cores or unscrewing
- Conventional air ejection
- Special press control for insert molding

Fellows

injection molding equipment

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CIRCLE INFORM-A-GRAM KEY NO. 8

don't overlook this way to save on your production costs

Typical application of OK Wear Plates on automotive die.

OK aluminum bronze wear plates for cam dies are now being used by the majority of appliance builders and automotive body makers. Here's why: You save approximately 40% under the cost of expensive solid bronze wear plates . . . and you receive completely finished wear plates, available from stock, ground to ± .0005 parallel and flat. By a unique cladding process, long-wearing aluminum bronze is bonded to a steel base, easily machinable for fitting to dies. Drilling or counterboring can be done through bronze surface if required. Wherever your die has a sliding or cam action, you'll achieve finer results with OK aluminum bronze wear plates. Complete information is contained in our new OK Catalog. For your free copy, write Dept. 58-LL.

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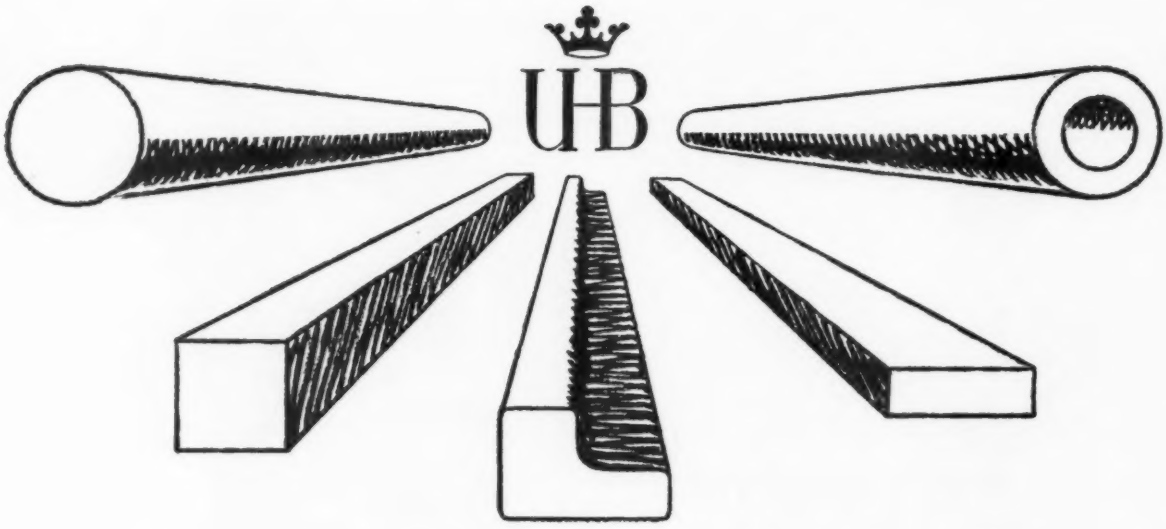

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UDDEHOLM TOOL STEELS

General Classification		SAE No.	Brand Name
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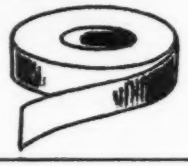
	Extra Quality	W1	UHB EXTRA
	Extra Quality	W2	UHB-VA
Shock Resisting Tool Steels		S1	UHB-711
		S5	UHB RESISTO
Cold Work Tool Steels	Oil Hardening Type	O1	UHB-46
	Medium Alloy Air Hardening Type	A2	UHB-151
	High Carbon, High Chromium Types	D2	TRI-MO
		D3	TRI-VAN
Hot Work Tool Steels	Chromium Base Types	H12	UHB SPECIAL
		H13	UHB ORVAR
	Chromium Tungsten Type	–	UHB-X1
Plastic Mold Steels	Straight Iron Type	P1	UHB FORMA
	5% Chrome Type	P4	UHB PREMO
Cold Heading Die Steel	Carbon Vanadium Type	W2	UHB-19VA

One call—to Uddeholm—is all you need to get the exact type of tool steel you want. And get it fast. You won't have to check other sources or accept "close" substitutes. For, in Uddeholm tool steel you'll find over 2800 different combinations of size, shape, grade and finish – one to meet *every* individual requirement. This variety includes drill rods, hot rolled and flat ground stock, plus Uddeholm's economical hollow tool steel and large-size sectional die steel. Added to this is the inherent Swedish quality that will reappear in *your* product – quality Uddeholm customers have come to "swear by."

Uddeholm Swedish Strip Steel is made from one of the world's purest iron ores—must pass a selective system of rigid inspection. This guarantees you a cold-rolled strip steel of consistent uniformity in composition, flatness, fine finish, edge straightness and dimensional tolerance accuracy. Widths range from 1/8" to 16 1/4", thicknesses from .001" to .125". Tolerances down to .00008" are possible. Applications include band saws (metal, wood and butcher), clock springs (flat and coil), intricate machine parts, flapper and flutter valves, Stainless Steel products, shock absorbers, razor blades, feeler gages, reeds, knives and many others.



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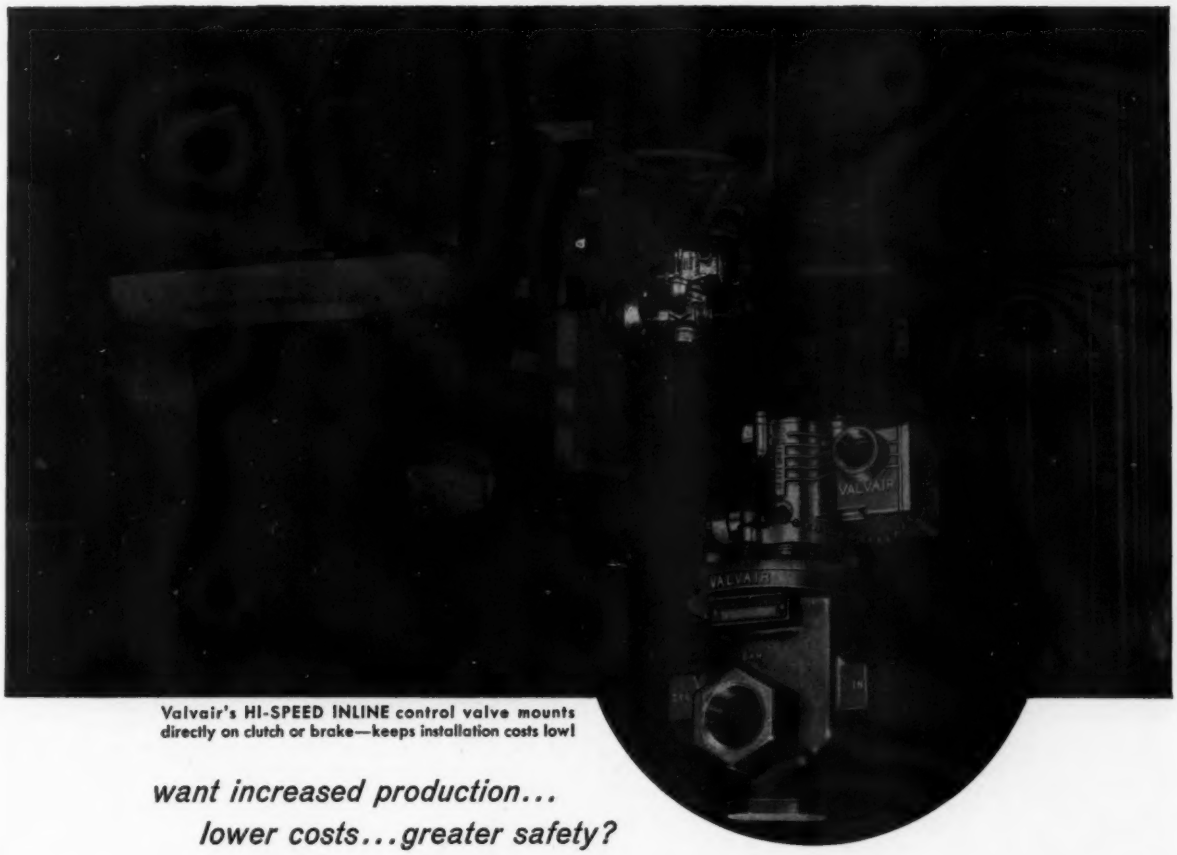
CIRCLE INFORM-A-GRAM KEY NO. 10



Valvair's HI-SPEED INLINE control valve mounts directly on clutch or brake—keeps installation costs low!

want increased production...
lower costs...greater safety?

use VALVAIR'S HI-SPEED INLINE VALVES

for instant-action control of clutches and brakes!

The split-second response of Valvair's pilot-operated HI-SPEED INLINE valves means shorter machine cycle time . . . more work per hour . . . more accurate cuts for high speed cut-offs . . . less clutch and brake slip . . . lower maintenance costs! And, precise control cuts machine set-up time . . . assures safer operation by minimizing drift.

Short travel, air cushioned poppet action is the HI-SPEED INLINE'S speed secret. Simple design assures multi-million cycle dependability . . . the valve has only 3 moving parts!

Built to Valvair's high standards, the HI-SPEED INLINE features cast Navy M bronze bodies, pilots built to JIC standards and fully interchangeable with your Speed Kings, solenoid coils guaranteed against burn-out for the life of the valve, plus molded Hycar poppet seals. Manual over-ride and integral junction boxes optional.

Valvair HI-SPEED INLINES *are available for immediate delivery from stock,* in sizes and types for every need. Specify them on new equipment . . . use them to replace obsolete valves now in service . . . one installation will convince you! Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio.

AA-5250

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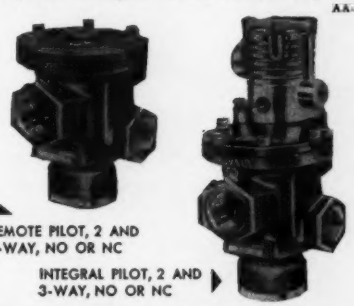
Compare ... and you'll buy

Valvair

Sizes range from ¼ to 1½ in. NPT. Solenoid pilot coils for ac or dc, any voltage. Working pressure, 10 to 200 psi.



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CIRCLE INFORM-A-GRAM KEY NO. 11

The ordinary fasteners securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

Vibration won't loosen self-locking UNBRAKO socket cap screws

HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 36, Pa.

UNBRAKO SOCKET SCREW DIVISION

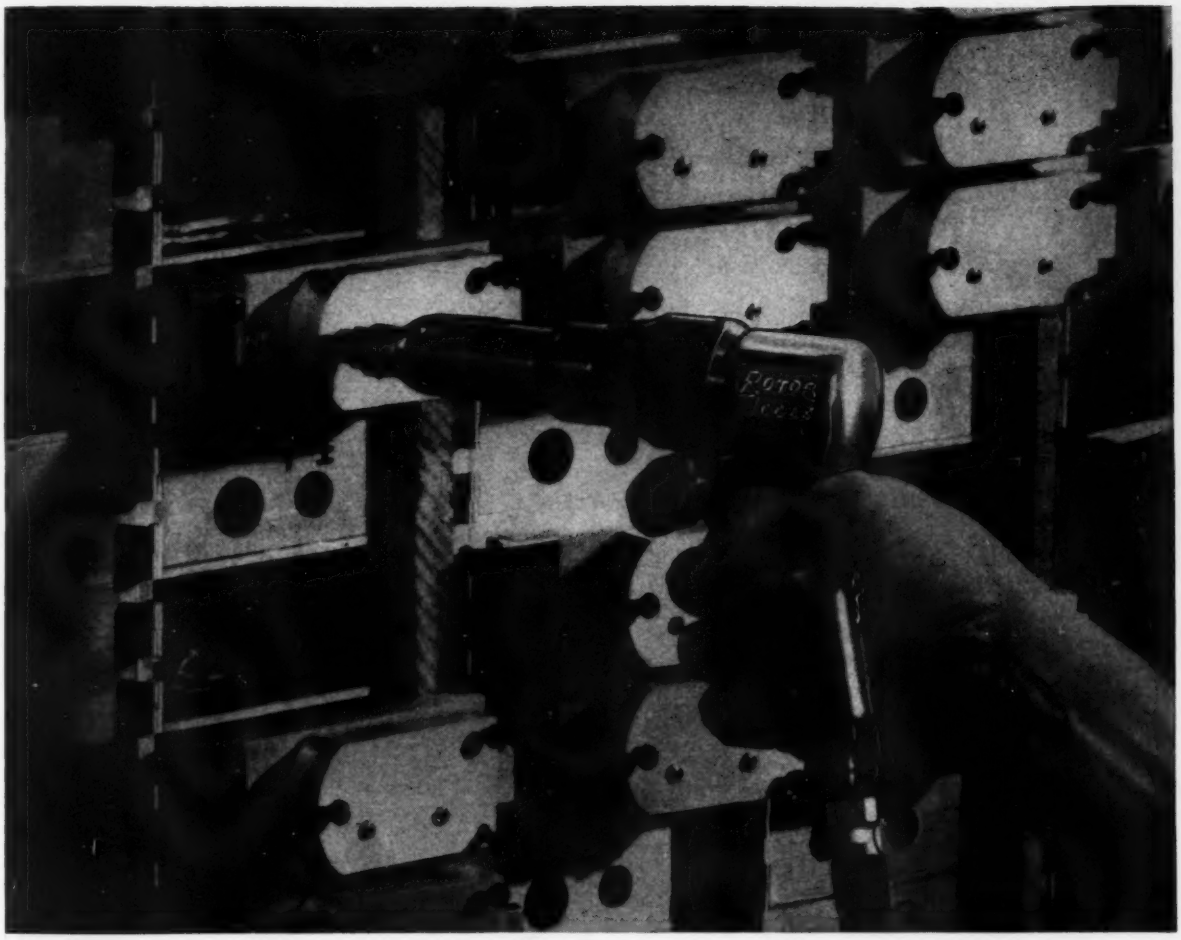
STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

CIRCLE INFORM-A-GRAM KEY NO. 12



Cuts screw-driving time 66%

APPLICATION: Rotor S-02 Air Screw Drivers on vault assembly job *paid for themselves in 8.6 weeks.* **RESULT:** Time per unit with former hand screw drivers was 13 seconds. With the 2000 rpm S-02 PRC, it is 4.4 seconds.

Rotor S-02 screw drivers and nut setters are available with three types of drives, with reversible or non-reversible motor, lever or pistol throttle, and with long or short angle head (with six different spindles). At least three speeds for each model. All models are quieter. Ask for a demonstration on your job. Bulletin 46 free on request. The ROTOR TOOL Company, Cleveland 32, Ohio.

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
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Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
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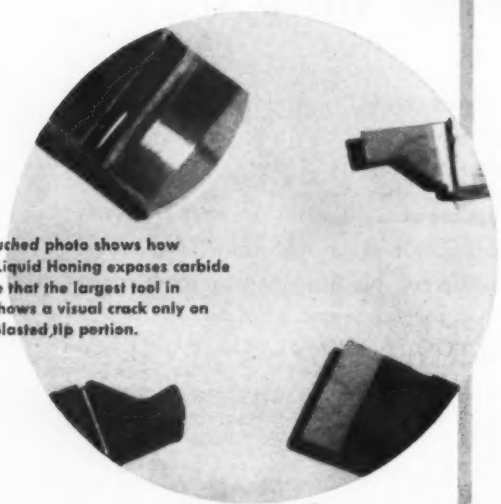
CIRCLE INFORM-A-GRAM KEY NO. 13

Detect Carbide Cracks Quickly, Positively... with V-B Liquid Honing*

Now you can prevent profit losses traceable to new or reground carbide tools that break because of cracks, porosity and other imperfections. Liquid-abrasive action flushes out the fine sintered material which, under grinding heat and pressure, often seals minute cracks and prevents detection by other methods. After Liquid Honing, fissures and other defects become *visually apparent* in a satin matte finish that remains dimensionally the same as the previous finish. Liquid Honing inspection processing is fast and thorough — more than 100 single-point tools per hour. And those tools, if not defective, last longer and cut better because they're free of burrs.

*Vapor Blast and Liquid Honing are trademarks.



This *unretouched* photo shows how effectively Liquid Honing exposes carbide cracks. Note that the largest tool in the group shows a visual crack only on the Vapor Blasted tip portion.

A Liquid Honing machine for carbide crack detection serves you in many other ways. Use it for surface conditioning, finishing, cleaning or descaling — often at production savings of 65% to 80%!

Write for complete information on case histories and low cost — only $550 to $1500 for a standard machine. And send a sample tool or part for free demonstration processing.

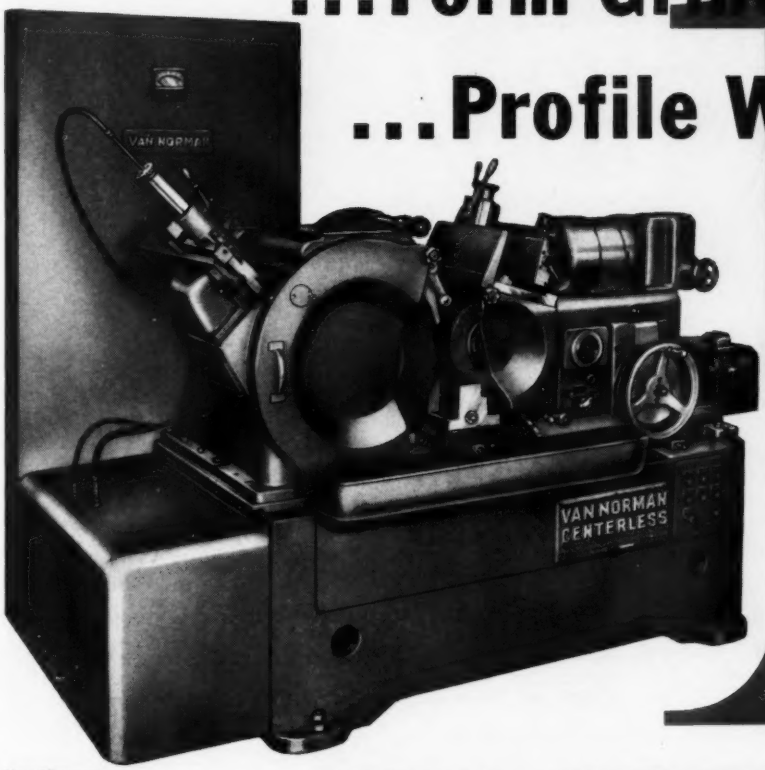
VAPOR V-B BLAST
MILWAUKEE WISCONSIN

VAPOR BLAST MFG. CO.
3131 W. Atkinson Ave. • Milwaukee 16, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 14

Now you can do:

Thru-Feed Work...In-Feed Work ...Form Grinding ...Profile Work with ONE



Van Norman
2C Centerless Grinder
Capacity: 0" to 4¾"
15 HP main drive motor.
(20 HP available)

VAN NORMAN 2C
CENTERLESS GRINDER

Featuring a 15 HP main drive motor which provides ample power for every grinding job, the Van Norman 2C Centerless Grinder actually gives you the facilities of *3* centerless grinders . . . standard grinding for thru-feed work . . . standard grinding for in-feed jobs and, equipped with crush dressing attachment, form grinding and profile work.

Get complete details on this newest in the expanding line of Van Norman grinders. Write, wire or telephone today for descriptive catalogs.

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . up to 10 years.

Check these features of the Van Norman 2C Centerless Grinder:

- ✓ Hard chrome plating of regulating wheel slide preserves original factory built-in accuracy.
- ✓ Grinding wheel and regulating wheel spindles are of a unit type construction . . . totally enclosed with double-row super-precision bearings, sealed and lubricated for life — assuring rigidity and accuracy previously unobtainable in centerless grinding, vibrationless operation.
- ✓ Spindles require no warm-up period, eliminating "creep."
- ✓ Infinitely variable regulating wheel drive.
- ✓ Combination straight and profile hydraulic wheel dressers for each wheel.
- ✓ Crush dressing attachment.

VAN NORMAN MACHINE COMPANY

SPRINGFIELD 7, MASSACHUSETTS

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

CIRCLE INFORM-A-GRAM KEY NO. 15

Special Punches and Die Buttons

have R-B Standardized Features

Special punch-points and mating die buttons of any shape or size can be made to your specifications and will have all the features of standard R-B equipment. These inherent R-B features include: snap-action radial alignment and vertical locking of special punches and die buttons, speed and ease of insertion or removal, and complete interchangeability. Just a push, a twist and "click" the R-B punch or die button is locked in the retainer—no additional keying required.

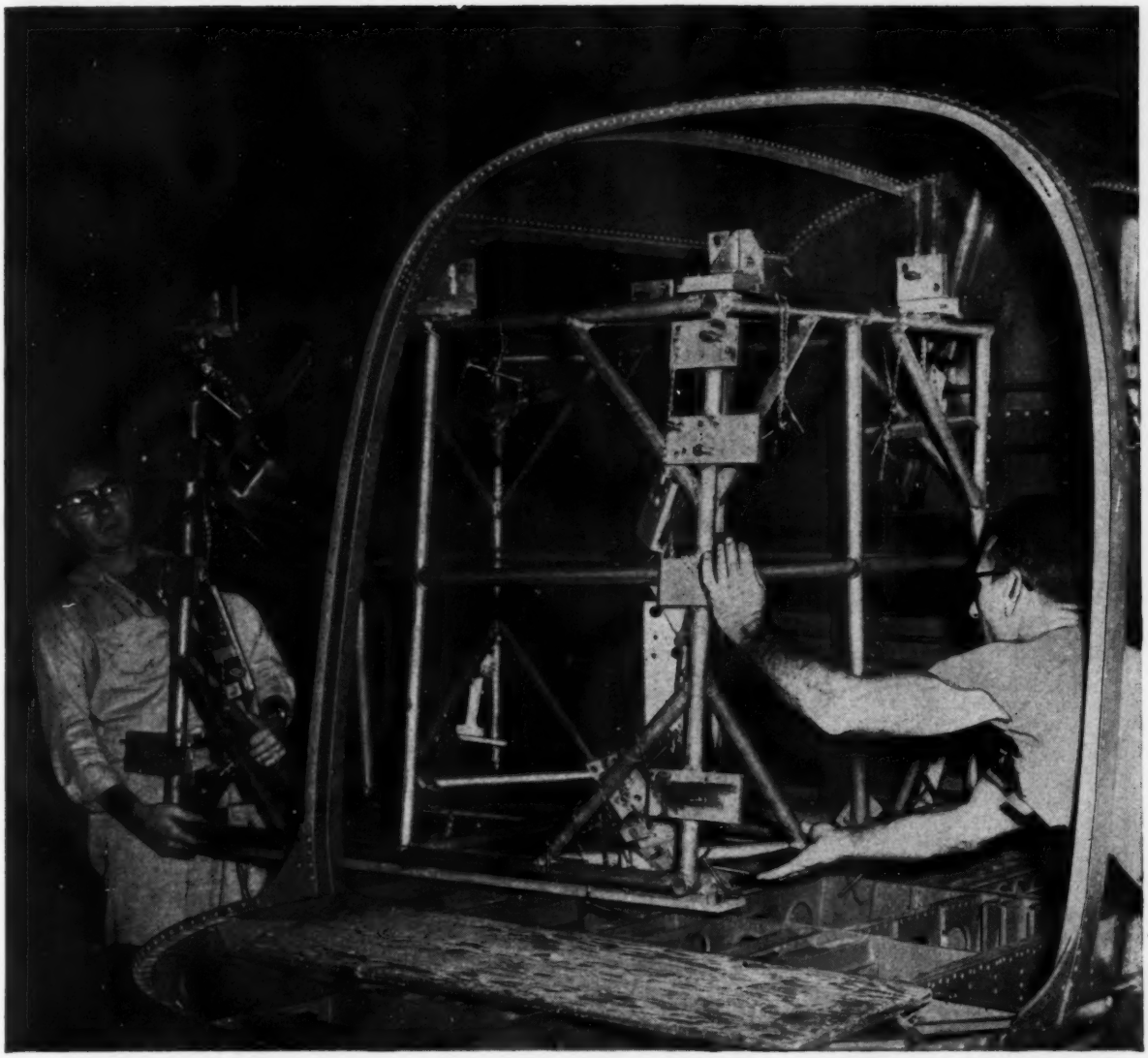
No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

- ★ Cutting Your Production Costs
- ★ Reducing Die Designing Time
- ★ Increasing Productivity of Presses
- ★ Supplying Answers to Piercing Problems
- ★ Saving Die Construction Time
- ★ Complete Standardization of Press Tooling

For Additional Information or Engineering Service, Write to:

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 87 • 26476 CAPITOL AVENUE • DETROIT 39, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 16



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

"Light magnesium tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415W.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

CIRCLE INFORM-A-GRAM KEY NO. 17

LepeL
HIGH FREQUENCY
Induction
HEATING
UNITS

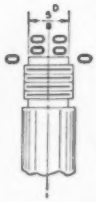
BRAZING
HARDENING
BOMBARDING
SOLDERING
ANNEALING
MELTING

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

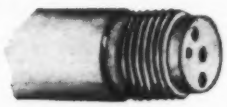
If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

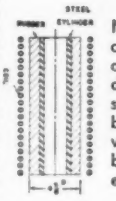
HARDENING
DIESEL FUEL INJECTOR



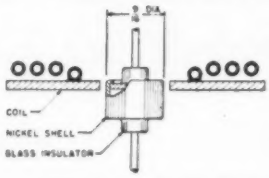
Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.



REMOVING
RUBBER FROM STEEL



Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.

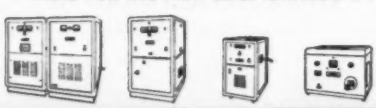


SOLDERING TRANSISTOR ASSEMBLIES

Concentrator-type coil creates high intensity, restricted heating at joint of nickel shell and tinned glass, thus causing solder flow for permanent seal.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 18

Talk of the Month

TOOL PROOFING: A MEANS OF QUALITY CONTROL

by A. S. Billings
Director, Quality Control
RYAN AERONAUTICAL COMPANY
San Diego, California

OUR COMPANY CONDUCTS business both as a prime contractor (to the Air Force, Navy and Army) and as a subcontracting manufacturer of specialized aeronautical products. These latter items are produced for aircraft engine manufacturers and for the military services.

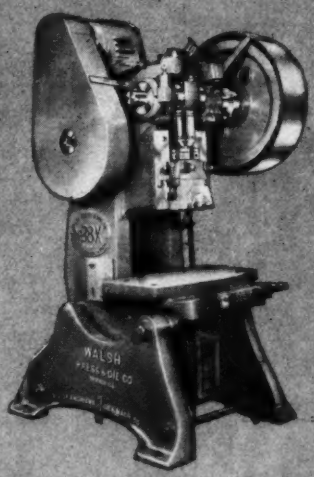
Ryan's traditional diversification has projected the company into research, development and manufacture of all three elements of modern flight vehicles; the airframes, the engines to propel them, and the electronic equipment to guide them. These typical items which Ryan produces are:

Afterburner Components
Jet Engine Components
Aircraft
Pilotless Aircraft
Rocket Motors
Aircraft Engine Exhaust Systems
Airframe Components
Metallurgical Engineering
Weapons System
Airborne Electrical Equipment

The Ryan Aeronautical Company produces over 250 different articles which are divided into the various categories listed above. Obviously, to produce this quantity of different items for three branches of the military services and 13 other customers for whom we are subcontractors (each customer has his own quality control standards) presents a major challenge from both a quality control and production standpoint. All of our subcontracting customers use the basic MIL-Q-5923B Specification as

. . . *Continued on Page 26*

From the 2nd Annual Quality Control Conference, Cleveland Section, American Society for Quality Control.



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Rugged as the Rockies

Some made in 1907 with rugged dependability are still operating at a profit. Wide selection of sizes from 6-65 tons . . . STOCK to 4 weeks delivery. 24 HOUR REPAIR SERVICE See Bulletin 353 for more details.

WALSH PRESS & DIE CO.

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SIZE CONTROL REVERSIBLE GAGES

. . . give you 5 or more gages for the price of one—*reversible* and extra length for new gaging surfaces at no additional cost.

THREAD REVERSIBLES
PLAIN REVERSIBLES

Complete details in catalog 53

SIZE CONTROL CO.

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Divisions of

AMERICAN GAGE and MACHINE CO.

SIMPSON ELECTRIC COMPANY **SIZE CONTROL COMPANY**

WALSH PRESS & DIE COMPANY

STANDARD TRANSFORMER CO.

CIRCLE INFORM-A-GRAM KEY NO. 19

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

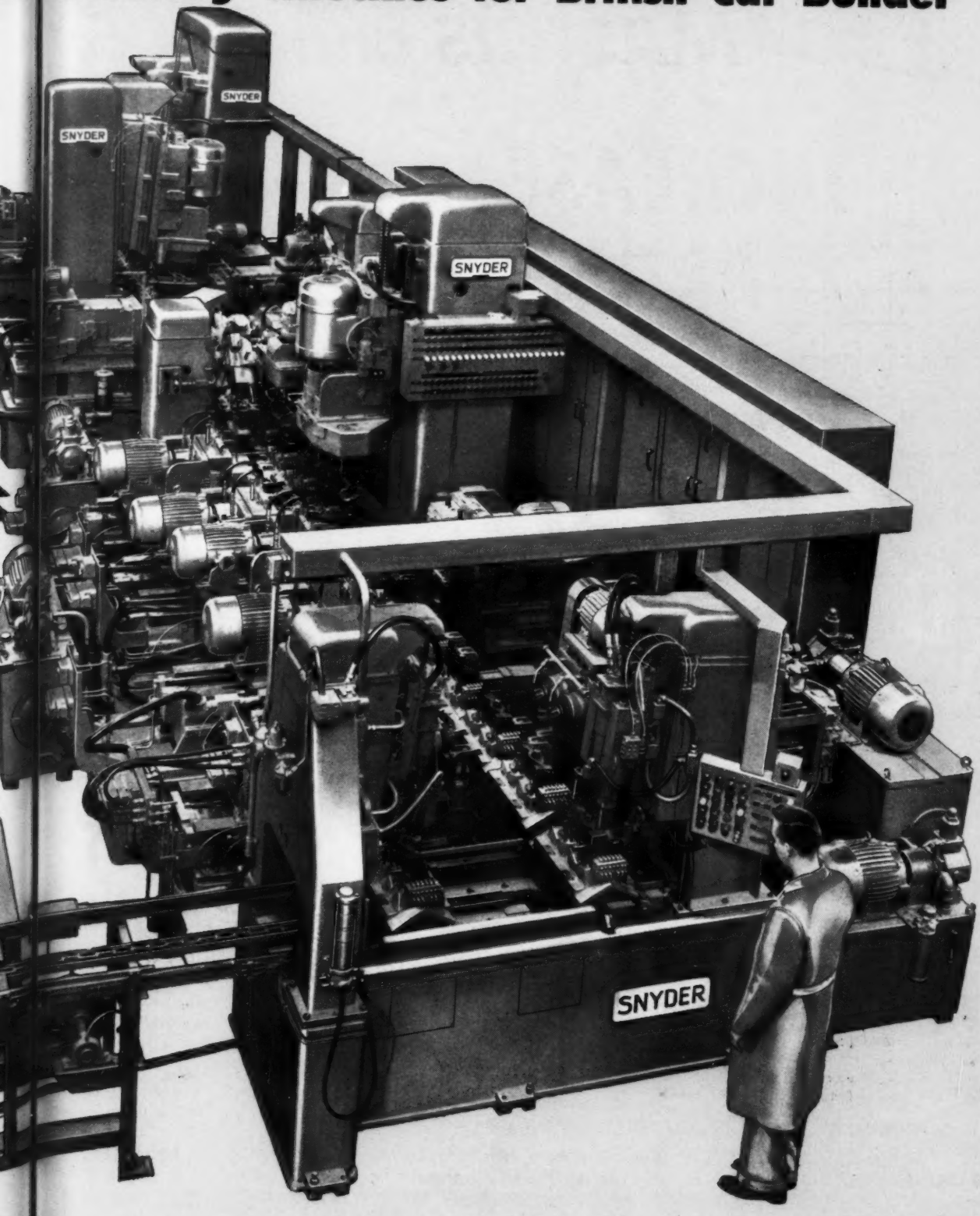
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

Several Semi-Standard Machines with Steering Knuckles for British Car Builder



HARDINGE
ELMIRA, N.Y.

MASTERS and PADS

INCREASE PRODUCTION

ON AUTOMATIC SCREW MACHINES

STYLE "B"
MASTER FEED FINGERS and PADS

Pads Cannot Work Loose
No Screws—No Pins

Available For: Brown & Sharpe
Cleveland — Cone — Davenport — Greenlee
Gridley and Acme-Gridley — National Acme
New Britain — Warner & Swasey

STYLE "S"
MASTER COLLETS and PADS

The Only MASTER COLLET with
No Work Pressure On The Screw

Available For: Cleveland-Cone
Greenlee — Gridley and Acme-Gridley
National Acme — New Britain
Warner & Swasey

CARRIED IN STOCK FOR PROMPT DELIVERY IN:

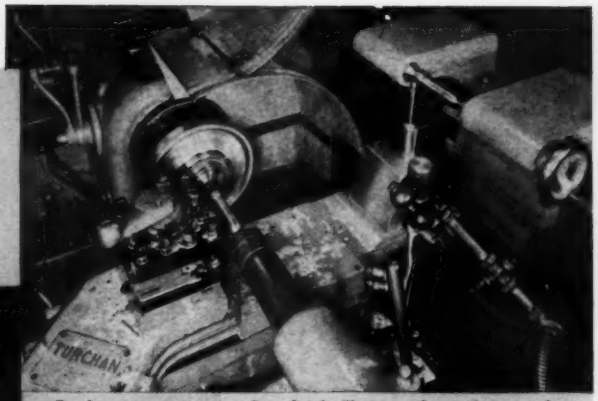
Baltimore, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, Minneapolis, New York, Oakland, Philadelphia, St. Louis, Toronto, and Montreal

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 22

Turchan HYDRAULIC TRACER CONTROLS

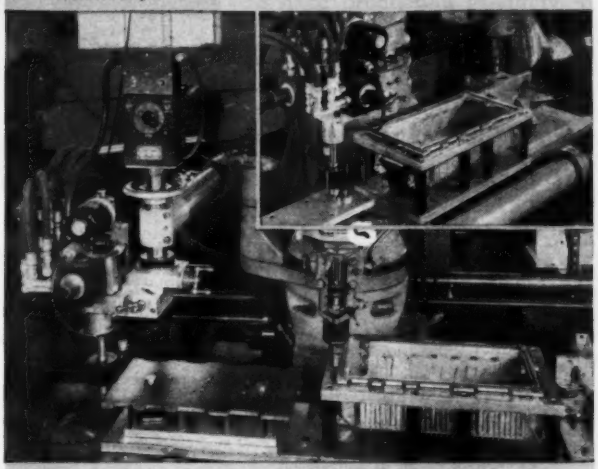
THE SIMPLEST SYSTEM OF MORE PROFITABLE PRODUCTION



Turchan tracers assure a finer finish. The smooth, continuous advance of the carriage by power feed, coupled with the floating action of the angular tool slide, produces a turned surface of unsurpassed smoothness. In many instances final grinding is unnecessary.

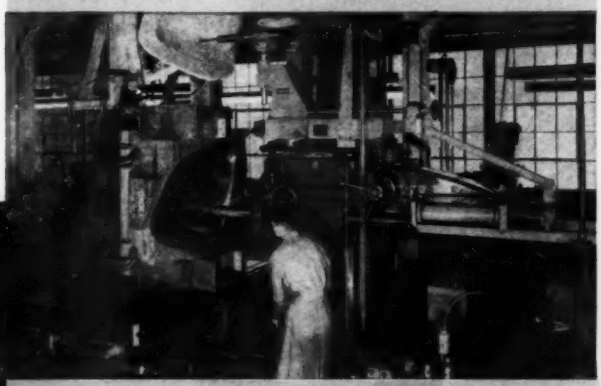
TURNING
MILLING
BORING
PLANING
SHAPING

Machine tools equipped with Turchan tracer controls handle a greater variety of work faster and more accurately. Standard operation of the machine is possible by a simple switching mechanism which converts the machine quickly from straight work to intricate profiling and contouring and back again.

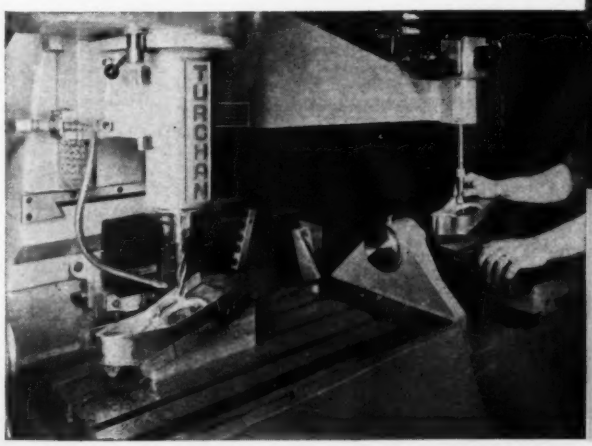


Complicated work requiring contouring, grooving and profiling are handled easily with Turchan Tracer control. In most cases many extra operations are reduced to one set-up.

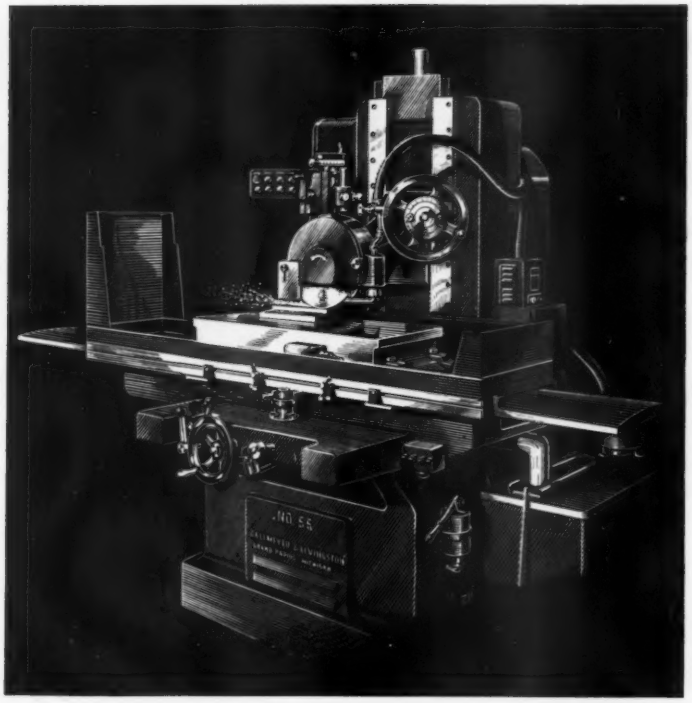
TURCHAN
FOLLOWER MACHINE CO.
P. O. BOX 6055 • DEARBORN 9, MICH.



Turchan units are supplied complete. Installation is very simple and all installations are supervised by a Turchan engineer.



Write today for your Turchan Folders. If you have a production problem Turchan has the solution.



Questions you should ask before you buy a

SURFACE GRINDER

- Are column and base *one piece* for permanent, vibrationless rigidity?
- Are both longitudinal table travel and cross feed hydraulically actuated?
- Is the wheel head powered for rapid vertical travel?
- Is it equipped with Vickers vane type hydraulic pump?
- Is the longitudinal table capable of speeds up to 125 fpm?
- Is it equipped with greased-for-life, pre-loaded ball bearing spindle?
- Does the wheel head have 18 inches of vertical movement?
- Is the spindle capable of speeds of 1925 and 2500 rpm?
- Does it have a 12" x 36" table working surface?
- Is it equipped with Bijur one-shot lubricating system?

You'll Choose Grand Rapids Grinder, No. 55 because it's the only grinder of its type that answers an emphatic "yes" to every one of these ten important questions.

Write for 24 page book that tells all about it.

GALLMEYER & LIVINGSTON

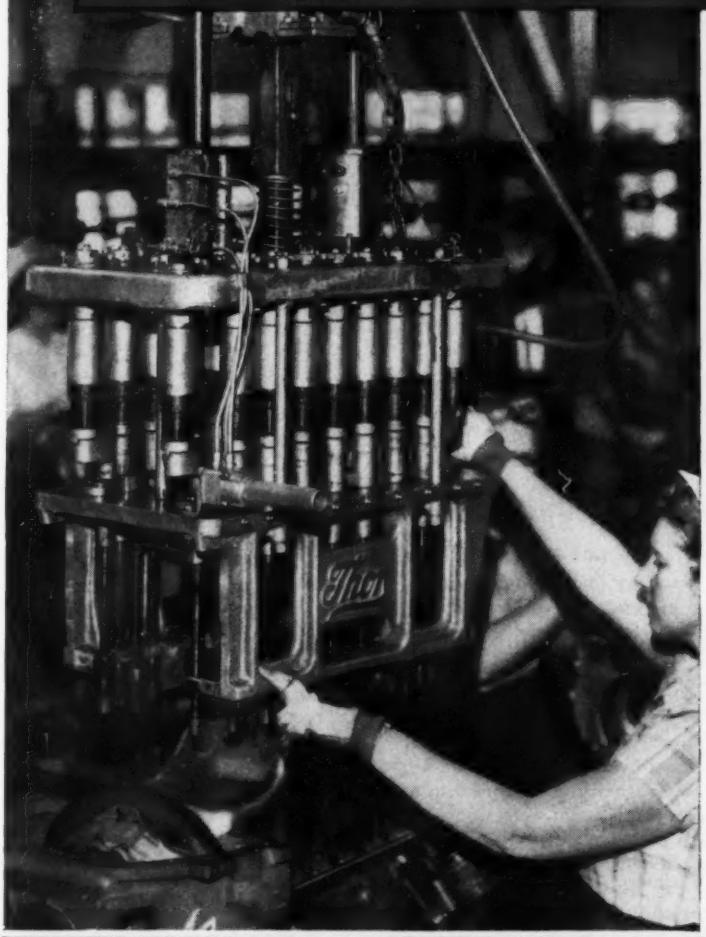
GALLMEYER & LIVINGSTON COMPANY

495 Straight Ave., S.W., Grand Rapids, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 24

If you run two or more fasteners at the same time—cut costs with

THOR MULTIPLE NUTSETTERS AND SCREWDRIVERS



Now, thanks to Thor multiple nutsetters and screwdrivers, the largest to the smallest assembly operation can enjoy the cost cutting benefits of automation. If you have production assembly jobs involving 2 to 20 or more nuts or screws, Thor multiples can return their cost in labor savings, in improved quality control, time and time again.

Running multiple fasteners at one time means every fastener is tightened to identical torque simultaneously with no shift in tensile load equilibrium which occurs when fasteners are tightened one at a time.

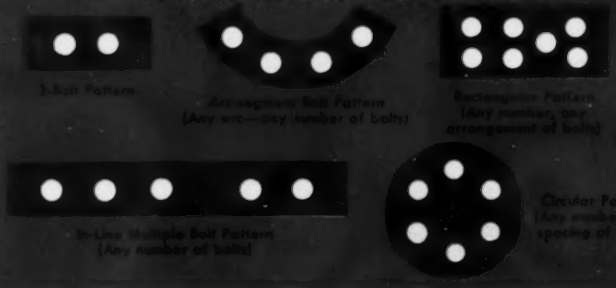
For the complete story of how Thor multiples can help you, write today for Thor's free book "Automation in Assembly." Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.

THOR POWER TOOL CO., CHICAGO

Branches in all principal cities

Thor PORTABLE POWER TOOLS

Thor multiple tools can be custom-built to any pattern, any number



FREE

AUTOMATION MANUAL ON MULTIPLE FASTENER SETTINGS

Pictures, diagrams, all the facts

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

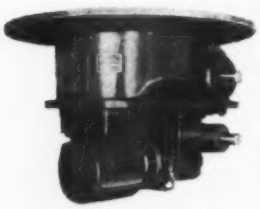
CIRCLE INFORM-A-GRAM KEY NO. 25

STANDARDIZED AUTOMATION!

Stock 36" Intermittor with special jig-bored dial

50% - 100% Increase in Production with FERGUSON HIGH SPEED INDEX TABLES

Up to 30,000 Pieces per Hour



Standard Table and Power Section

Stand and Auxiliary Tool Mounting Plates

The standard Ferguson Intermittor is a *must* for operations such as machining, joining, forming, staking, piercing, assembling, testing and inspection that require a combination of high speeds, long dwell or work time, and smooth indexing.

There is a standard Intermittor for almost every application, offering a choice of stops, dial size, degree of movement; and a table for either extreme precision or high torque usage. Seldom do you have so much selection in a line of standard production machinery . . . with all of the benefits of standardization PLUS many of the advantages of custom designs! The Intermittor operates at speeds far greater than those possible with other types of index tables. The special acceleration characteristics of the FERGUSON ROLLER GEAR DRIVE insure smooth starting and stopping with little shock and vibration, at speeds up to 500 indexes per minute.

Over 150 standard models . . . many in stock! Get complete information on load ratings and dimensions . . . write for your file copy of Catalog No. 301.

HIGH SPEED INDEXING • STANDARD TRANSFER MACHINES • AUTOMATIC TOOLING

FERGUSON MACHINE CORPORATION OF INDIANA

Roller Gear Division, Dept. HIS • P.O. Box 5841, St. Louis 21, Mo.

CIRCLE INFORM-A-GRAM KEY NO. 26

. . . Proofing from page 18

a minimum requirement starting point and add their own individual requirements.

In order to maintain a positive control over the maze of requirements necessary to produce finished products acceptable to all concerned, one basic organizational concept must be realized. The Director of Quality Control should report directly to the President. This elementary requirement is in effect in our organization.

As a result of many years of study and trial a very efficient and satisfactory quality control organizational set-up has been evolved. The Director of Quality Control has the three major quality control activities reporting directly to his office:

Chief Inspector
Material Review
Tooling Inspection

This type of functional control is very satisfactory and produces a substantial cost saving in that it streamlines authority and eliminates a system of useless reports.

These opening paragraphs are not meant as an advertisement for Ryan, but are placed here for explanatory purposes for those individuals who may not be familiar with this type of operation.

The tooling inspection department is under the direct supervision of a General Supervisor and is staffed by a group of inspectors who comprise 20% of the total of 375 employees in the quality control department. Each major type of manufacturing activity such as airframe, jet components, fabrication, etc. has a tooling inspection supervisor to handle tool inspection in his particular bailiwick.

Each new product (of which there are many) is assigned to a particular tooling inspection supervisor. It is his responsibility to follow development of all tools and procedures during development. The below listed significant points must be watched closely during development of a new product:

(a) Precise mating of parts into assemblies (tool proofing)
(b) Practicability and producibility of fabrication, assembly and inspection tools.
(c) Proper sequential assembly of details to provide for heat treat operations, etc.
(d) Final dimensional accuracy.
(e) Control the pilot run of details to minimize amount of scrap due to functionally incorrect tools.
(f) The tool must hold and index any number of parts consistently the same so that the operation performed on the part is within Engineering print tolerances.
(g) Tools must hold and index parts as fool-proof as possible to eliminate loading errors.

During the development period of a new product the inspection

. . . *Continued on Page 29*

Acme-FETTE

NEW SERIES - "N" SELF-OPENING THREAD ROLLING HEAD

lets you use your present equipment

(either rotating or stationary spindles)

for rolling threads from the end

VERSATILE—Same head can be used on any type of turning equipment—either rotating or stationary spindles—on all jobs which permit clearance for front plate. Reduces secondary operations.

FAST—Thread rolling speeds are equal to turning speeds with high-speed tool steels—on all ferrous and most non-ferrous materials; up to 5 times faster than conventional thread cutting methods.

SMOOTH, TOUGH, EXTREMELY ACCURATE—Metal flows to full depth of thread; forms a dense, uniform structure with no cratering at the crest; provides a burnished thread surface remarkably resistant to wear and corrosion.

NO CHIP PROBLEM—Thread Rolling with an Acme-Fette is ideally suited to multiple-spindle tooling setups.

FOR EITHER LONG OR SHORT RUNS—Production records (names on request) prove substantial cost savings due to easier setup, less down time and more mileage per set of rolls.

WIDE RANGE—8 Acme-Fette Thread Rolling Heads provide for capacities ranging from 1/8" to 2".

Check where Acme-Fette can help you keep more of your present equipment busy. Send sample or print for our recommendation—or write for your copy of Bulletin NAF-57

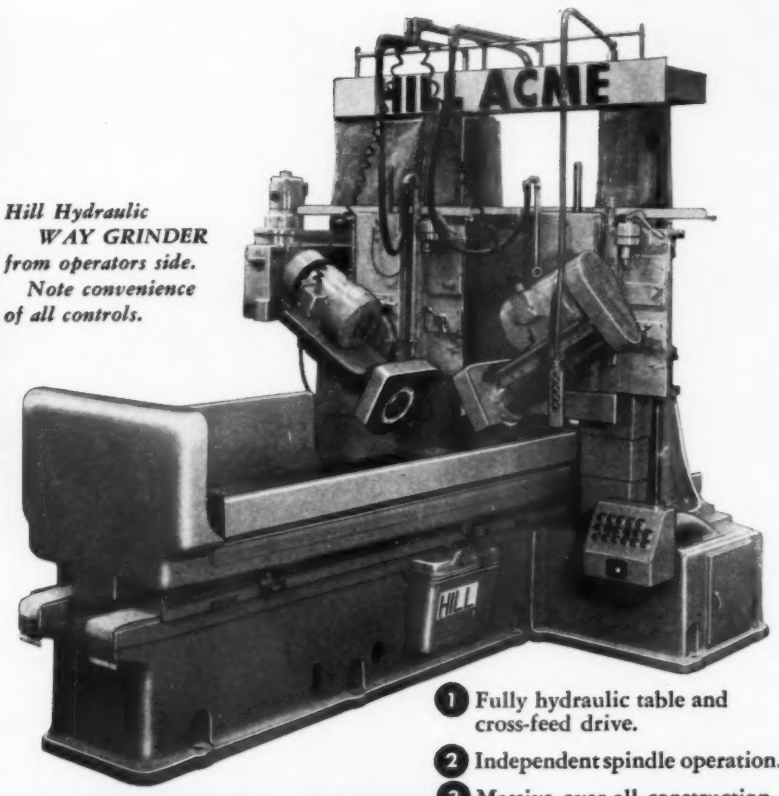
ACME-FETTE NEW SERIES "N" HEAD (Size 00) Rolling No. 6-32 Class 3 Thread on a Single Spindle Automatic Screw Machine.

National Acme

THE NATIONAL ACME COMPANY
169 EAST 131ST ST., CLEVELAND 8, OHIO
SALES OFFICES: Newark, Chicago, Detroit

HILL double housing WAY GRINDER for accurate grinding of V's, Flats and Angles

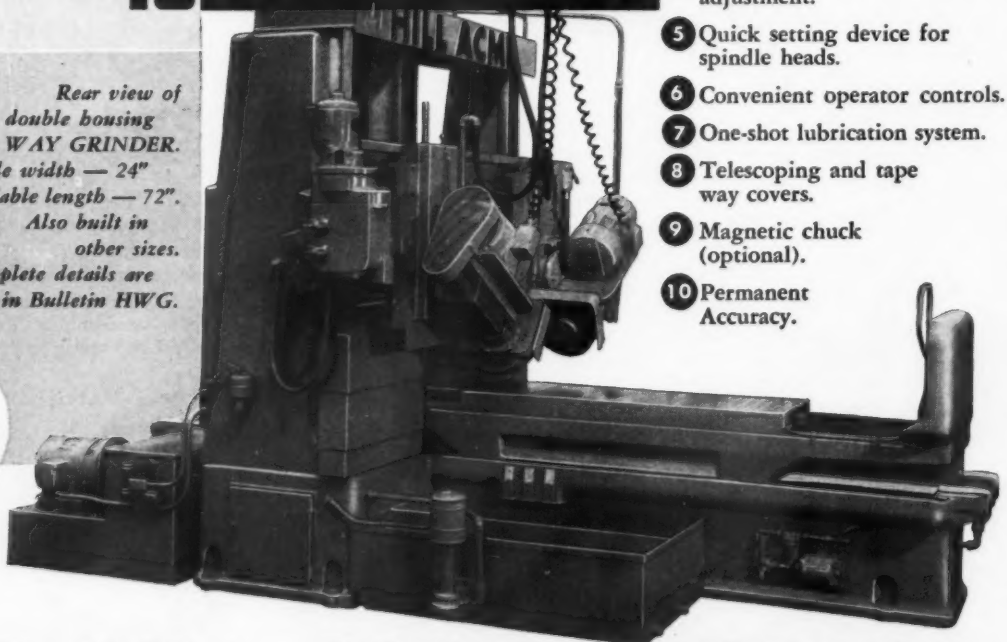
Substantial Savings (up to 50%) over previous methods.



Hill Hydraulic WAY GRINDER from operators side. Note convenience of all controls.

10 points worth considering

1. Fully hydraulic table and cross-feed drive.
2. Independent spindle operation.
3. Massive over-all construction.
4. Rapid traverse and fine feed adjustment.
5. Quick setting device for spindle heads.
6. Convenient operator controls.
7. One-shot lubrication system.
8. Telescoping and tape way covers.
9. Magnetic chuck (optional).
10. Permanent Accuracy.



Rear view of HILL double housing WAY GRINDER. Table width — 24" Table length — 72". Also built in other sizes. Complete details are given in Bulletin HWG.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

CIRCLE INFORM-A-GRAM KEY NO. 28

. . . Proofing from page 26

sequences to be used in production are developed and a production inspector receives an indoctrination course on the peculiarities of this new item. When a sufficient quantity of acceptable new products has been produced to satisfy Tooling Inspection that the item is ready for production, the entire "package" is handed to Production and Production Inspection as a proven product. Tooling Inspection continues to act as a "watchdog" over this item in production and is available as a "trouble-shooter" on tooling problems.

The tooling inspection office maintains a complete set of "Master Planning" on each part involved in each respective area so that it can move quickly when action is required, and can make a necessary planning change through manufacturing engineers on the production floor without making a career of the operation.

Tools which come under the jurisdiction of Tooling Inspection are classified into four (4) categories as follows:

1. SOFT TOOLS
   This group includes templates, router blocks, Hydro form blocks, drop hammer dies, etc. The general Engineering tolerances for the parts produced from these tools is ±.030" or more.
2. DIES AND FIXTURES
   Tools which perform a close tolerance function on a part and must be coordinated with other tools in a family i.e. drill jigs, mill fixtures, lathe fixtures, weld jigs, punch press dies, sub assembly jigs, final assembly jigs, etc.
3. TOOLS PRODUCED BY OUTSIDE VENDORS
   Machine tools and large assembly fixtures are controlled, inspected dimensionally and accepted by Ryan Tooling Inspection at the vendor's plant if the program in which the tool is involved is on a priority schedule. Otherwise the tool would be received and inspected in the normal manner.
4. INSPECTION FIXTURES
   These fixtures and gages are all controlled by Ryan Tooling Inspection. The inspection control requirements for the above emanates from the Quality Division in coordination with Manufacturing Engineering, Production Control and Tool Planning. Copies of these requirements and control are of sufficient number so that not only do the "Chiefs" receive them but also the individual "Indians."

In addition to Tooling Inspection's duties of inspecting and proving new tools, a constant tooling vigil is maintained in the punch press department. By visually inspecting each 50th part coming off of each press a

. . . *Continued on Page 34*

Jarvis Adjustable Pitch
LEAD SCREW TAPPER

NEW!

. . . a cost-cutting OPPORTUNITY you can't afford to miss! One tapper . . . one lead screw . . . convertible in SECONDS to tap *different* pitches!

ANOTHER Jarvis *FIRST!*

send this coupon TODAY!

Jarvis Corporation
Middletown, Connecticut

Yes! I am interested in this new, Jarvis First—the Adjustable Pitch Lead Screw Tapper.

☐ Send details and prices
☐ Have a Jarvis representative call
☐ We would like a demonstration in our plant

NAME..... TITLE.....
COMPANY.....
ADDRESS.....
.....

CIRCLE INFORM-A-GRAM KEY NO. 29

Northwestern TOGGLE-SHOE CLAMPS

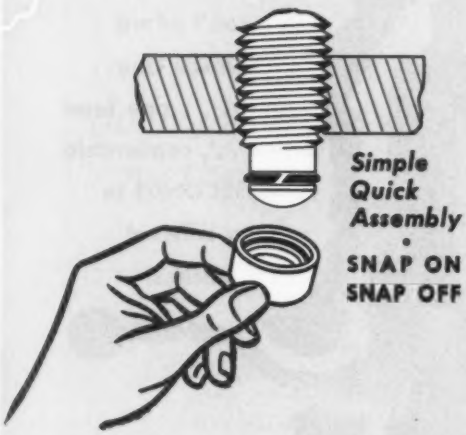
THREE NEW SOCKET TYPES! KNURLED SHAFT • KNURLED HEAD • HAND KNO

ALL TYPES ARE INTERCHANGEABLE WITH *"SNAP ON-SNAP OFF"* ROUND OR V-PAD

PATENT APPLIED FOR

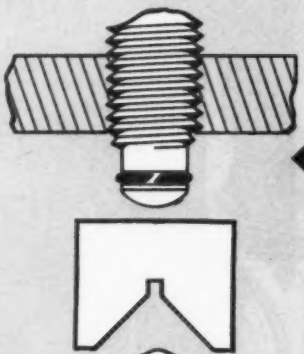
SIZES — ¼-20 to ⅜-11 **LENGTHS — 1" up to 5¼"**

There is a dealer near you that stocks Northwestern Tools — Write for information.

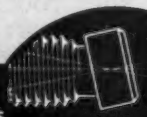


Simple Quick Assembly

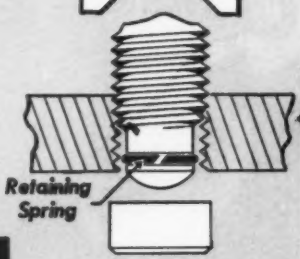
• SNAP ON SNAP OFF



10° ADJUSTMENT in all directions



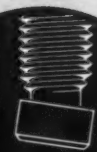
Retaining spring holds shoe in place yet allows a full 10° adjustment in all directions



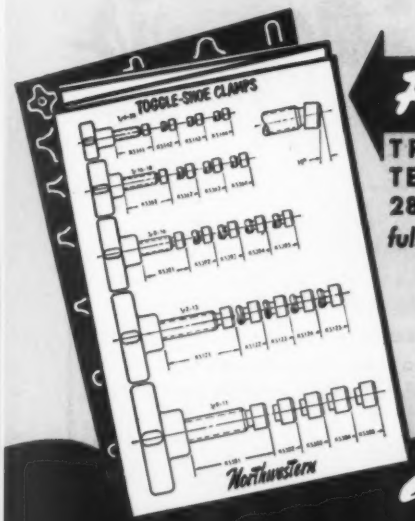
Retaining Spring

NO INTERFERENCE

Shoe only 1/16 larger than bolt



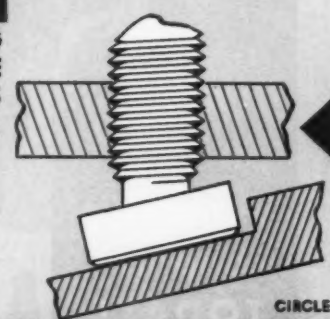
Short shoe design requires a minimum distance between fixture and the work.



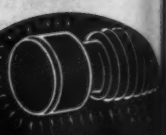
Free

TRACING TEMPLATE 286 ITEMS

full Scale • •



HEAT TREATED for max. toughness



Screw is heat treated for long life — shoe is heat treated to prevent marring of work

CIRCLE INFORM-A-GRAM KEY NO. 30

116 HOLLIER AVE. **Northwestern** DAYTON 3, OHIO

ALL THE **PRODUCTION** YOU'LL *EVER* WANT—

ALL THE **PRECISION** YOU'LL *EVER* NEED

RIGIDITY and STAMINA TOO!

Generates spur gears, spiral gears, bevel gears, face gears, worm gears, worms, spline shafts, gear sectors and pinions. 12 hob speeds, from 109 to 1259 R.P.M. Helix leads from .800" to 130". Generates gears with as few as 3, or as many as 650 teeth. Speed, feed, and indexing, each can be selected independently. Capacity from .050" to 6" O.D. of gear blank depending on gear characteristics. Free Bulletin No. 2544 provides full information.

2544

It's the

Hamilton

PRECISION SMALL-GEAR HOBBING MACHINE

THE HAMILTON TOOL COMPANY • 832 SOUTH NINTH STREET • HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 31

VK "Quality in Millionths"

VK WIRE TYPE PLUG GAGES
XXX TO ZZ ACCURACY

STEEL, CHROMIUM PLATED or TUNGSTEN CARBIDE

The illustration above shows three Van Keuren wire type plug gages, one of steel, one chromium plated, and one of tungsten carbide. All three are Class XXX, accurate within ten millionths of an inch. This is VK "Quality in Millionths".

You may not require tolerances of this order. Van Keuren wire type gages are available in standard tolerances also, from XX to ZZ, in sizes from .001" to 1.000", in steel, chromium plate or tungsten carbide, whichever material best suits your gaging job. Handles may be either Van Keuren or A.G.D. as preferred.

Notice also that VK units in all three materials are not only reversible but long enough to be cut off or cut in half, thus realizing from two to ten gages from each 1⅞" and 2" long unit. This extra length represents extra quality, extra saving, on every Van Keuren wire type unit your company buys.

VK wire type plug gages are fully described in Catalog and Handbook No. 36, available on request. The next time you need quality plug gages in a hurry, telephone The Van Keuren Co., Watertown, Mass. (WA 4-4394). In many cases we can ship your requirements from stock.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

38th YEAR

THE Van Keuren CO.,

171 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers
Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires
Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service

CIRCLE INFORM-A-GRAM KEY NO. 32

Fully Automatic Finger-Tip Controls

Reid-O-Matic Model 824 . . . the most versatile surface grinder in today's metalworking field, is completely electric . . . fully automatic. A control panel, at finger-tip level provides complete power control of all grinder adjustments.

Reid-O-Matic operators can "set-up" faster . . . change settings quicker . . . produce close tolerance grinding in the toolroom without unnecessary labor. For your surface grinding specialists, the new Reid-O-Matic is a "Production Giant."

SPECIFICATIONS

Capacity: 8″ wide, 24″ long, 21″ high from table to center of spindle. Standard wheel 12″ x 3″ x ¾″ included.
Table Speed: Infinitely variable from 0 to 90 F. P. M.
Cross Feed: Infinitely variable from .001 to .250.
Floor Space: 93″ x 51½″ x 71¾″ high.
Weight: 4,000 lbs., Net.

For Production and Toolroom Grinding . . .

REID BROTHERS COMPANY, Inc.

133 Elliott Street, Beverly, Massachusetts

Write for Bulletin 824

MANUFACTURERS OF PRECISION SURFACE GRINDERS AND PRODUCTION LATHES

CIRCLE INFORM-A-GRAM KEY NO. 33

. . Proofing from page 29

close control is maintained over tool performance. A dull or broken punch is discovered before excessive scrap is generated. The tool proofing inspector stationed in the punch press department is directly responsible for ascertaining that defective dies are reworked and will produce a blueprint part.

The mechanics of tool proofing of parts from presses by the sampling method has proven itself a tremendous cost saving operation with no surrender of quality in any way. In fact, it has increased the volume of parts produced and has resulted in better quality and less down time on the machines. Quality trend charts compiled in this area are excellent.

Another facet of the duties required of the tooling inspection group is the formulation of positive corrective action when tools are determined as the cause for the rejection of parts. Our system requires that a definite and realistic corrective action statement be placed on a rejection tag before parts in question can be accepted through Materials Review. It is the duty of the applicable tooling inspector to furnish this information to the Materials Review Board quickly and accurately so that acceptable parts can be returned to the production line without delay.

A record of all investigations and corrective actions on each specific item is on record in both the tooling inspection office and the materials review office. It is through the medium of this type of control that we have been able to come up with our "Quality Control Trend Charts" which is our basis of positive communication between production management and top management for our weekly and monthly discussions. Also, with this overall control we are able to supply to our military or prime contractor's source inspector accurate and detailed information on any given set of circumstances.

The completed rejection tags contain all of the basic data for the reduction of future discrepancies. A running detailed analysis of this data is conducted by the quality control group and is supplied to the other departments in several forms.

The most direct and immediate form consists of Red Caution Cards given directly to the production superintendents to highlight major problems.

The most detailed form consists of a monthly Department Responsible Report listing all of the month's rejections, each analyzed, and grouped into their generating departments.

A Summary Report is issued to the local Air Force Quality Control Office every month giving a brief on production, rejection rates, and repeat rejections.

Local weekly reports are dispatched to clarify certain trouble spots as needed.

The broad overall pattern of our production progress is presented to management and to our customers in the form of Quality Trend Charts showing a running plot of the production-rejection ratio and a plot of the percent of those rejections which are repetitive.

Our analyzed historical record permits closer bidding by locating and fixing costs and points the way to production processes to be used. Thus we are controlling the long term, short term, the broad and the specific problems inherent in precision mass aircraft production.

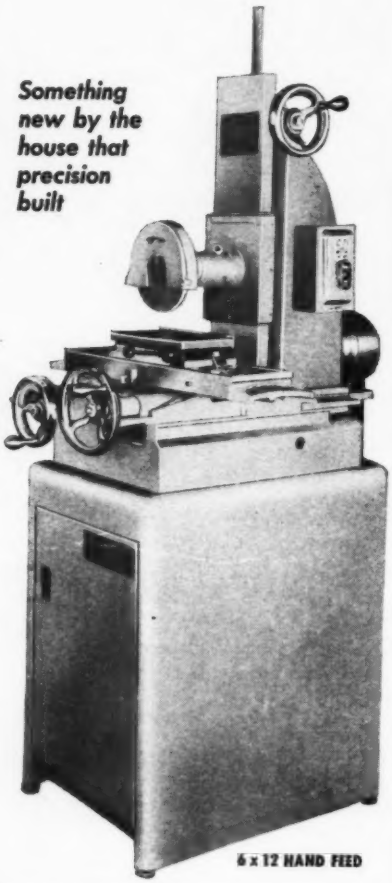
However, please bear in mind that, to have a system of this type, it is certainly in order to inform the reader that the key personnel in the Quality Control Department at Ryan have been associated with this department for a period of fifteen (15) years. This system of operation can only be obtained by qualified personnel in the overall plan. Without very capable "Indians" there would not be many successful "Chiefs."

It is a privilege to be a small part of this program of the American So-

. . . Continued on Page 36

TML BY Harig

Something new by the house that precision built



6 x 12 HAND FEED

6"x12" precision surface grinder

The new TML by Harig provides extremely fast and accurate grinding, with a new operational ease never before known. 100% more longitudinal travel than before with each rotation of the wheel. You get smooth surfaces in minimum time. Economical—low maintenance.

SPECIFICATIONS

Longitudinal travel .....12⅜"
Transverse travel .....7"
Vertical travel .....12¾"
Working surface of platen .....12" x 6" ½" T slot
Grinding wheel .....7" dia. x ½" face
Grinds 12¾" over platen with 7" wheel
Standard spindle speed 3000 R.P.M.
½ or ¾ H.P. motor—Net wt. with motor 575 lbs.

Can be used with or without floor stand.

Harig Manufacturing Corp

5761 W. HOWARD ST. • CHICAGO 31

SEND ME LATEST BULLETIN ON THE NEW TML GRINDER BY HARIG

Name_____ Title_____

Company_____

Address_____

City and State_____

CIRCLE INFORM-A-GRAM KEY NO. 34

Business-machine parts stamped with dies made by Eglinton Carbide Products, Inc., Lincoln Park, Mich.

Stamp pre-tempered steel .020 to .040 in. thick . . .

DIES MADE WITH CARBOLOY® CEMENTED CARBIDE SAVE BURROUGHS CORPORATION $300,000 A YEAR!

Dies equipped with Carboloy® cemented carbide now enable Burroughs Corp. to stamp business-machine parts from pre-tempered steel 2-4 times thicker than previously possible.

Parts made from pre-tempered (instead of annealed) stock come out of the dies finished . . . and made to required hardness. This permits Burroughs to eliminate many secondary operations. On one of the parts shown above, for example, heat treating, shaving, straightening, and five other operations are eliminated. Yearly saving on this part alone amounts to over $300,000 . . . and more than 10,000 hours of production time.

These savings far more than pay for carbide dies. In addition, carbides bring new savings in downtime and grinding costs because of their phenomenally long service life. A carbide die has stamped 1,000,000 pre-tempered steel parts per grind . . . while steel dies producing the same part from *annealed* stock had to be re-ground after only 10,000 parts.

Our engineers will work with you or your die maker on the application of Carboloy Cemented Carbides to your dies. For more information, write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Blvd., Detroit 32, Michigan.*

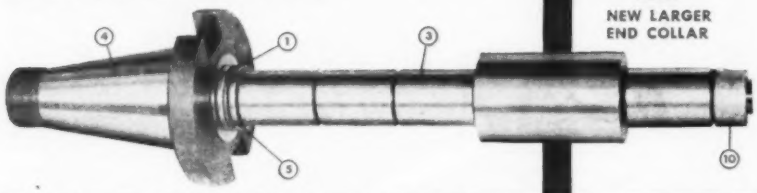
Progress Is Our Most Important Product

GENERAL ELECTRIC

CIRCLE INFORM-A-GRAM KEY NO. 35

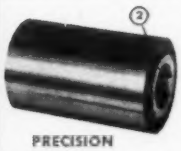
EXCLUSIVE NEW FEATURES OF SCULLY-JONES ARBORS

give you extra-precision milling at the same low cost!



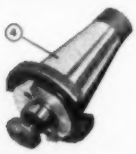
NEW LARGER END COLLAR

These benefits	...for these reasons	..result from these PREMIUM features
PREMIUM ACCURACY	No "cocking" of spacers when "snubbed up" on arbor.	1. New, larger end bearing and collar insure perfect alignment; 45 deg chamfer in collar for clearance over fillet.
		2. Bore and outside diameter of bearing sleeves concentric within .0005 in.; faces of sleeves and collars parallel within .0002 in.
PREMIUM TOOL LIFE	No runout, each tooth of cutter takes its share of the load.	3. Arbor and pilot diameter held to plus .0000, minus .0005 in. with .0005 in. minus tolerance.
		4. Taper held within .0002 in., with 10-20 micro-inch finish.
		5. New, larger size and grooved OD make it easy for operator to identify end collars, help to prevent mistakes.
PREMIUM PRODUCTION	Reduce down-time.	6. Keyways standard in all sleeves and collars. Can be keyed to arbor to prevent rotation.
		7. True-running arbor helps eliminate premature cutter failure.
	Reduce setup time.	8. Adjustable spacing collar speeds adjustment between gang mills and saws.
PREMIUM ARBOR LIFE	Accuracy lasts longer.	9. Forged steel arbors hardened throughout to 42-45 Rockwell, "C". Sleeves hardened on OD and faces to 60 Rockwell, "C". Collars hardened throughout to 40-45 Rockwell, "C".
		10. Hardened and ground threads for arbor nut.
	Fortified against breakage under heavy loads.	11. New, larger fillet increases strength at stress point between arbor and shank.



PRECISION BEARING SLEEVE

SOLID AND ADJUSTABLE SPACING COLLARS



SHELL END MILL ARBORS

SCULLY JONES

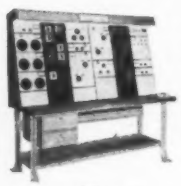
Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1913 South Rockwell Street, Chicago 8, Ill.

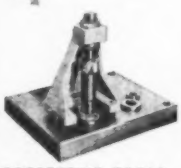
For profit-minded tool buyers!



"TOOLITROL" BOARDS
Take the human element out of multiple-spindle operations, help control quality and production.

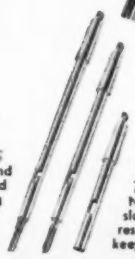
NEW TENSION AND COMPRESSION TAP HOLDERS
Lock-and-eject chuck speeds tool changes, increases holding power.

HEAVY-DUTY TAP DRIVERS
Improved snap-ring design increases accuracy and holding power, speeds tool changes.



PRESETTING TOOLS
Reduce setup time, downtime, and inspection time by as much as 50 per cent.

TURRET TOOL HOLDERS
Hardened and precision ground to resist nicking and wear, assure accurate tool alignment.



CLOSE CENTER TAP DRIVERS
New design with four-slot chuck increases resistance to pull-out, keeps taps running true.

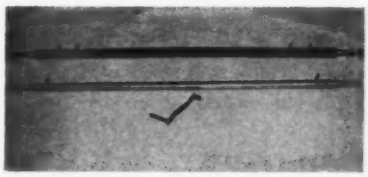
CIRCLE INFORM-A-GRAM KEY NO. 36

. . . **Proofing from page 34**

ciety for Quality Control and it is hoped that this effort will convey to you gentlemen that the aircraft quality control personnel are vitally interested in your organization.

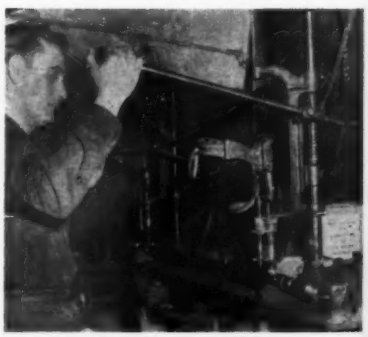
END WELDED STUDS IMPROVE DESIGN AND CUT PRODUCTION COSTS

Versatility of end welded studs, and their dual ability to improve design and cut production costs, are illustrated by their use on the very popular small boat trailer, made by the Tee-Nee Trailer Co.



Either two or four studs are used on axles to secure the trailer springs. Two special studs are used on the winch handle.

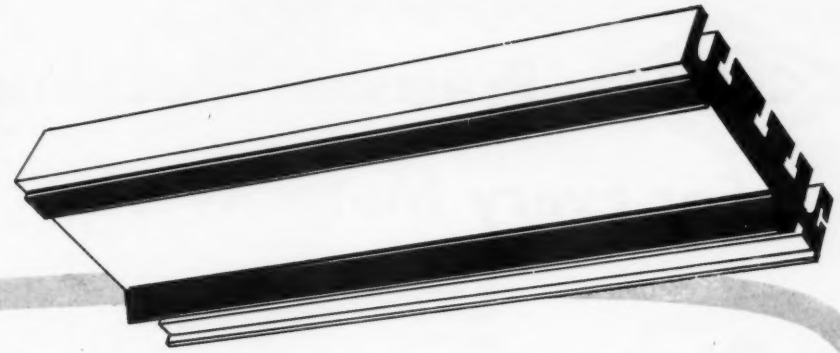
On two trailer parts, the axles and winch handles, three types of Nelson studs are end welded. To secure the springs to the axles, standard ½" x 1⅝" threaded studs are used. On the handles there are two special studs. One is a ¾" dia tapped stud with internal threads that engage the winch. The other, which holds the handle in a clip, is a ½" x 4" unthreaded stud, grooved ⅛" from the unloaded end.



Nelson stud welding guns, mounted in drill press fixtures, are used to weld studs to axles of Tee-Nee boat trailers.

The clean design incorporating end welded studs would have been impossible with any other fastening method, according to Tee-Nee officials. The most likely alternative — throughbolts — would have required drilled holes and more tedious assembly methods.

* Pioneered by Covel and first introduced at the 1947 Machine Tool Show. Available on all Covel surface grinders.



Save Re-scraping...Save Money! with COVEL HARD CHROME TABLE WAYS*

COVEL No. 10 SURFACE GRINDER

6"x18" Hand or Power Feed

Engineered to give you the most accurate gage, form tool and surface grinding performance at *low initial cost*. Smooth timing belt drive, hardened and ground lead screws and rigid vertical slide insure precision operation.

Hard Chrome Table Ways Reduce Maintenance Costs

This Covel introduced feature preserves the built-in accuracy of hand-scraped ways for extra years of precision service.

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write for FREE BULLETIN

For all the facts about the rugged low cost Covel No. 10 write DEPT. TP-57

THE MOST COMPLETE LINE OF SURFACE GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • DRILL GRINDERS • OPTICAL COMPARATORS

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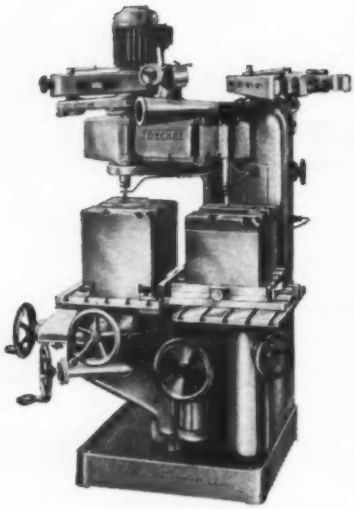
COSA

Precision Machine Tools For *Every* Metal Working Need



Deckel KF Universal Pantograph Die Sinker For 2- and 3-Dimensional Work

At Cosa you can choose from a complete selection of the world's finest machine tools and metal working equipment — for production line or tool room use. Standing behind every Cosa machine is a nation wide sales-service organization that offers you:

Sales Engineering — Machine tool experts will assist you in selecting the right equipment for your production needs.

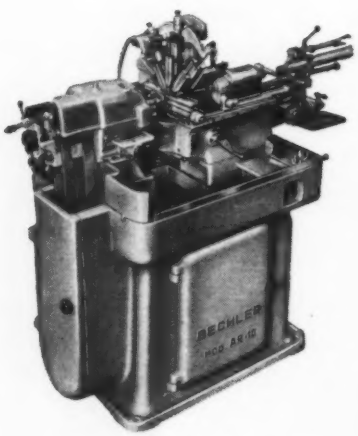
Installation — Factory-trained technicians will supervise installation, check performance, and instruct operators for best results.

Guarantee — Each Cosa machine is guaranteed against defective workmanship or materials for one year after delivery.

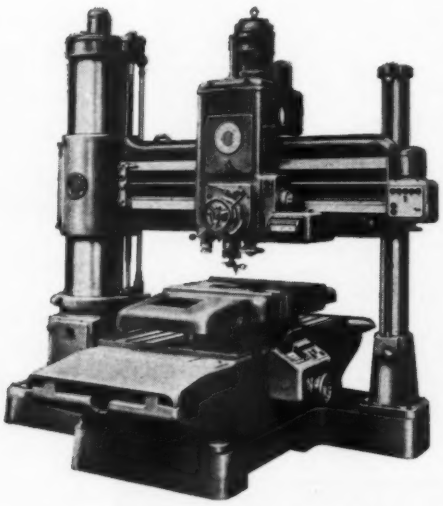
Service — Cosa's competent staff of skilled servicemen will help you to maintain peak performance — with quick delivery of spare parts.

CHECK COSA'S COMPLETE LIST FOR *YOUR* TOOLING NEEDS

Automatic Screw Machines—Swiss
Balancing Machines
Bending and Forming Machines
  Wire
  Roll
Boring-Drilling-Milling Machines
  Horizontal
  Jig
  Precision
  Vertical
Cam Cutters
Centers, Bench
Chain Making Machines
Clamps
Drilling Machines
  Horizontal
  Multi-Spindle
  Radial
  Sensitive
  Upright, Single Spindle
Dynamometers
Electrical Discharge Machines
Engraving Machines
  2- & 3-Dimensional Pantograph
Gages, Comparators
Gear Checking and Testing Machines
Gear Grinders
Gear Hobbers
Grinding Machines
  Cam & Contour
  Plain Cylindrical
  Drill, Tap and Flute
  Splines
  Thread
  Tool & Cutter
  Universal
Jig Borers
Keyseaters
Lathes
  Automatic & Semi-Automatic
  Bench
  Double End
  Engine & Tool Room
  Facing & Right Angle
  Gun & Shaft Boring
  Special
  Vertical Turret
Milling Machines
  Contour
  Die Sinking
  Plain
  Planer
  Tool Room
  Universal
  Vertical
Straightening Machines, Wire
Tapping Machines
  Single & Multi-Spindle
Threading Machines, Grinding
Tools, Machinists' Precision



Bechler Swiss Automatic AR-10 With 6-Tool Drum Turret



Kolb Optical Jig Borer For Positioning Workpieces To Within .00005"

COSA — *nationwide sales and service of precision machine tools — from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 38

TOOL NEWS carbide

Throw-away inserts in micro-adjustable tools drop costs from $4.50 per 1000 pieces to 43¢

WESSON Boring Bars Cut Turning Costs

Replacing conventional single point tools, Wesson-metal throw-away inserts in micro-adjustable **WESSON** boring bars are showing the following savings on a planet carrier housing turning operation:

Tool grinding eliminated
Tool cost cut from $4.50 to 43c per 1000 pieces
Tool-change down-time cut 93%
Tool re-setting after sharpening eliminated
Pieces per tool change almost doubled

Since the only change in the tooling, when dull, is to index the insert or replace it after 8 indexes, no tool-change-adjustment is required after the first setup. The latter is quick and positive because of the micro-adjustment feature (0.001 inches per graduation on the screw head).

Again, therefore, **WESSON** insert tooling demonstrates the ability to slash the really important tool costs—those hidden costs in tool grinding, down time, etc.—which usually far outweigh initial tool cost. The reduction in initial cost in this case was only 4 cents per 1000 pieces. The "upkeep" cost, however, was slashed $4.00 per 1000 pieces . . . without even figuring in the eliminated down time.

For data on these tools ask for Bulletin #MB-157.

Tool Blocks for Throw-Aways are Micro-Adjustable

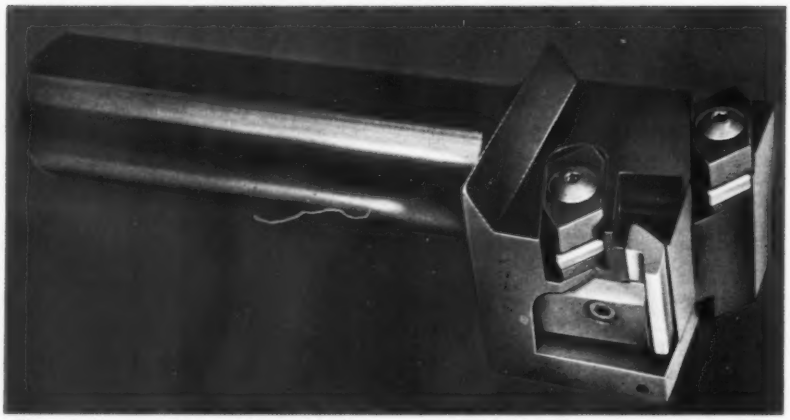
The **WESSON** tool blocks shown here are used to rough and finish turn and face transmission parts on an Ex-Cell-O two-spindle machine. Micro-adjustment permits rapid setup, each division on the calibrated screwhead being equal to 0.001 inch. The square inserts provide eight cutting edges, high production per insert, and low tool cost.

TOOL carbide NEWS

Throw-Aways for More New Uses

These three special tools perform a combined total of some 10 operations. The 4-tooth cutter in the rear is for counterboring. Its 4 teeth are micro-adjustable for diameter, the screw head being graduated in 0.001 inches of movement. Quill in the foreground is used for facing, forming a step, counterboring, grooving and chamfering. Tool at the right is used for combination of internal and external operations: turning two OD's, facing and counterboring. All have these features in common: They are designed to use Wessonmetal throw-away inserts; they are rapidly set up; they cut down-time for tool changing to a minimum; they eliminate all tool grinding; and they greatly reduce tool costs per piece produced.

Both Throw-Away and Slug-Type Inserts Used in Tool Holders

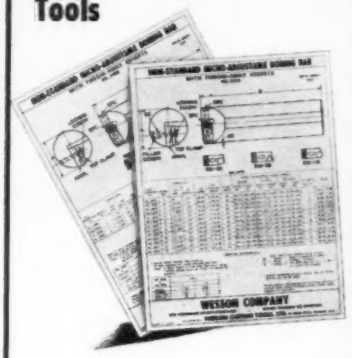


Throw-aways may be combined with slug-type inserts to effect optimum machining efficiency and economy. For instance, use of both slug type (on-end) inserts and throw-away types in the same tool holder is recommended where grooving is to be combined with such operations as turning or chamfering. Reasons: wear is greater on grooving than chamfering tools. Slug type insert can be quickly re-ground. Special throw-away insert for this use could not be indexed and would be too costly. Shown here is a typical tool holder with both types of inserts.

tools carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 16, ONTARIO

Ideas in Throw-Away Insert Micro-Adjustable Tools



Get our Bulletin #MB-157

You'll find it valuable in planning for the retooling of turret lathe operations on which you want to cut tool costs per piece and down-time for tool changes. Also gives specifications and prices, shows standard replacement parts, 15 line drawings.

Bulletin #PG-157

Get this bulletin. It will tell you how to cut your grinding costs on carbide tools, how to get greater diamond wheel life; how to boost grinder output per hour from 30% to 50%; how unskilled operators can get better tool finishes than skilled operators on other grinders; how to cut tool regrind cost almost in half.

LITHO IN U.S.A

Presenting the new

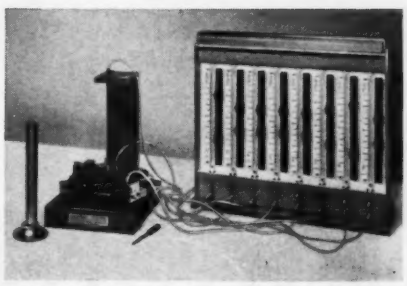
DEARBORNAIRE

COLUMN-TYPE AIR GAGING INSTRUMENT

Never before has there been an air gage instrument quite like the new Dearbornaire! For it incorporates a host of advanced design features that give you greater versatility and ease of operation with finer accuracy, minimum maintenance and lower gaging costs.

The characterized internal taper of its exclusive new glass tube assures positive linear accuracy over the full extent of the calibrated scales. Its zero-centered scales permit faster and easier reading . . . whether used for normal parts inspection, for statistical quality control, or as a tool setting gage. Interchangeability of its basic component parts simplifies conversion from one amplification to another . . . saves time, cuts costs. What's more, Dearbornaire's new higher rated pressure system and built-in circuit restrictions make it virtually self-cleaning . . . eliminate nuisance interruptions for service, reduce down-time to a minimum.

Single and multiple column instruments available now in standard amplifications of 1250-1, 2500-1 and 5000-1. Free demonstration arranged upon request. Write for complete information today!



● Multiple column Dearbornaire instrument and a special fixture equipped with Dearborn contact cartridges to check eight close tolerance dimensions at one time.

AIR GAGE DIVISION **DEARBORN GAGE COMPANY**

22038 BEECH STREET DEARBORN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 41

INDEX short or long runs on a production basis

with Hartford Special SUPER-SPACERS

- Quick, easy setups without expensive jigs or fixtures.
- Positive, rapid indexing accuracy in a minimum of .00116" on a 4" radius, noncumulative.
- Super-Spacer can be indexed visually to any degree setting with Vernier accuracy, and locked in position.

12" SUPER-SPACER

Length overall:	16"
Width overall:	12½"
Base to chuck face:	6 13/32"
Width of keys:	1 1/16"
Thru hole diameter:	4"
Chucking diameter:	½" thru 12½" O.D.
Weight:	190 lbs.

Mask plates for divisions from 2 through 27 are available from stock. 2, 3, 4, 6, 8, 12, 16 and 24 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 48 notch master index plate furnished with standard unit. Special master index plates for 27 through 54 divisions carried in stock. Special index plates for unequal spacing made to order.

8" SUPER-SPACER

Length overall:	12⅛"
Width overall:	10⅛"
Base to chuck face:	6 3/4"
Width of Keys:	1 1/16"
Thru hole diameter:	2½"
Chucking capacity:	⅛" thru 8" O.D.
Weight:	110 lbs.

Mask plates for divisions from 2 through 18 are available from stock. 2, 3, 4, 6, 8 and 12 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order.
24 notch master index plate furnished with standard unit. Special master index plates for 16 through 36 divisions carried in stock. Special index plates for unequal spacing made to order.

HARTFORD *Special*

Thousands of users the world over proclaim Hartford Special Super-Spacer The Standard of Indexing Devices for —

Milling	Boring	Inspecting
Drilling	Slotting	and other
Tapping	Planing	Machining Operations

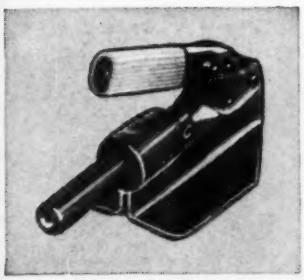
A complete line of accessories available. See the Hartford representative in your area or write for Bulletin S-104.

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2925 HOMESTEAD AVENUE HARTFORD 12, CONN

CATALOGS ON
TOGGLE CLAMPS
FIXTURE CLAMPS
LEAF JIGS

Only WESPO can furnish All the following work-holding devices

Write for **FREE CATALOG!**

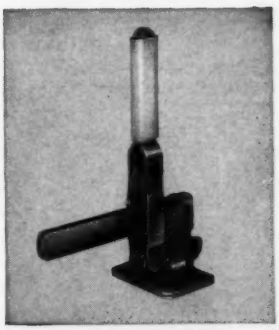


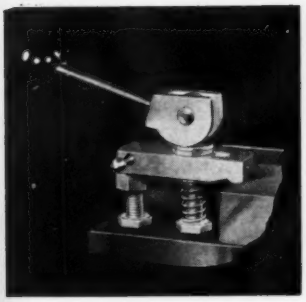
TOGGLE CLAMPS

Over 39 STYLES and SIZES . . .

NOTE THESE FEATURES:

1. Reamed holes—for better bearing.
2. Hardened Bushings, Serrated to prevent turning.
3. High tensile strength rivets—for longer service.

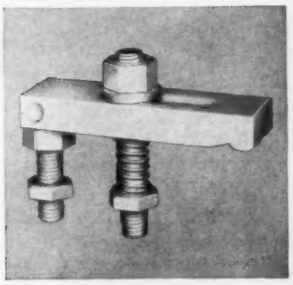




FIXTURE CLAMPS

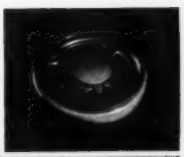
16 STYLES
170 SIZES

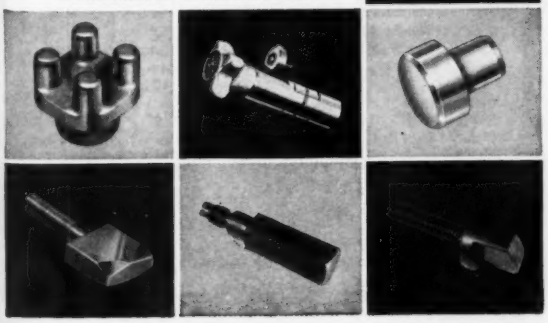
There is a WESPO Clamp Assembly to suit every job.



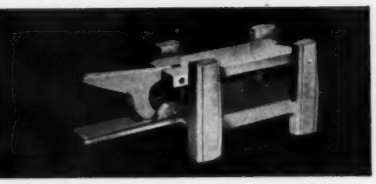
COMPONENTS

Over 1000 different Types and Sizes available from stock

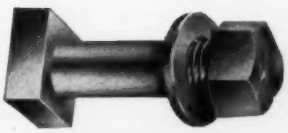




LEAF JIGS



Save 50% Designing Time and Toolmakers Cost.
23 Sizes, 1½" x 2" to 6" x 6".



T-BOLTS AND BOLSTER BOLTS

Made to J.I.C. Press Room Standards.

WEST POINT MFG. CO.

26935 W. 7 MILE ROAD • DETROIT 19, MICHIGAN

3 NEW HEAVYWEIGHT CHAMPS

in benchmaster's growing family!

Series 100
10 ton capacity

Here they are...3 exciting new Deep Throat Benchmasters built with all the pride and craftsmanship of the world's largest manufacturer of small presses and mills! These new models exceed all other Benchmasters in size, weight, work capacity and tonnage! With their sturdy, rigid frames you get all the latest refinements of Benchmaster's long experience in the field...*and remember 60% or more of all small presses sold are Benchmasters!*

For your deep throat requirements, for facilitating large pieces easier, use these new 10-ton Benchmasters... Unmatched for quality, *still* unbeaten for economy!

SPECIFICATIONS

SERIES "100" 10 TON DEEP THROAT PRESSES

	Model "100"	Model "110"	Model "120"
Crankshaft at Main Bearings	1½"	1½"	1½"
Standard Stroke	1¼"	1¼"	1¼"
Shut Height Bed to Slide, Stroke Down, Adj. Up, Std. Stroke	7¾"	10¾"	13¾"
Other Strokes Available	1½"-2" 2½"-3"	1½"-2" 2½"-3"	1½"-2" 2½"-3"
Shut Height for above strokes	7½"-7" 6½"-6"	10½"-10" 9½"-9"	13½"-13" 12½"-12"
Area of Bed front to back and left to right	8" x 11"	8" x 11"	8" x 11"
Bolster Plate Thickness	1"	1"	1"
Adjustment of Slide	1½"	1½"	1½"
Hole in Slide for Punch Shank	1⅜"	1⅜"	1⅜"
Center of Slide to Frame	12"	12"	12"
Flywheel Diameter and Face	18" x 3½"	18" x 3½"	18" x 3½"
Flywheel Weight (Approx.)	125#	125#	125#
Strokes per Minute	180-190	180-190	180-190
Motor H.P. and Speed	¾ HP 1140 RPM	¾ HP 1140 RPM	¾ HP 1140 RPM
Distance from Floor to Bed (Floor Models)	32½"	32½"	32½"
Distance from Bed to Center of Shaft	19¼"	22¼"	25¼"
Floor. Space FB × RL	20" x 35¼"	20" x 35¼"	20" x 35¼"
Overall Height	62¼"	65¼"	68¼"
Size Opening through Back	5"	5"	5"
Shipping Weight Less Motor (Approx.)	940#	975#	1010#

benchmaster

World's largest manufacturer of small punch presses and mills.

1835 West Rosecrans, Gardena, California

CIRCLE INFORM-A-GRAM KEY NO. 44

over 14,000 Different Cylinder SELECTIONS—

Miller

AIR AND HYDRAULIC

"STANDARDIZED" CYLINDERS

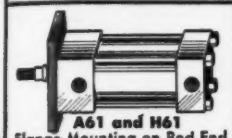
"IN STOCK"

for immediate delivery

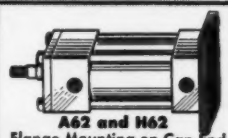
See Miller Bulletins A-105 (Air) and H-104 (Hydraulic) for Complete Dimensions and Engineering Data on these standardized "in stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 ft.

"IN-STOCK" MODELS

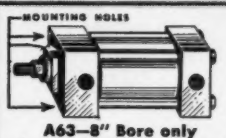
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)

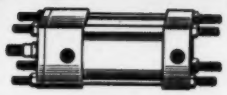


A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



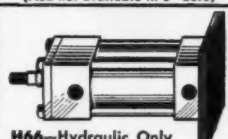
A63—8" Bore only
Flange Mounting on Rod End

A64—8" Bore only
Flange Mounting on Cap End

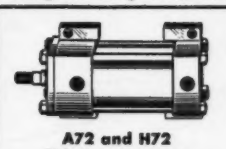


A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.

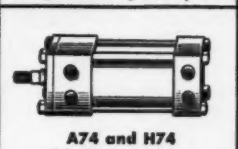
H65—Hydraulic Only
Flange Mounting on Rod End



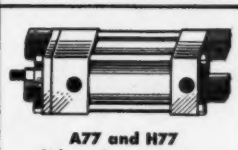
H66—Hydraulic Only
Flange Mounting on Cap End



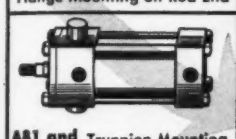
A72 and H72
Side Lug Mounting



A74 and H74
Side Flush Mounting

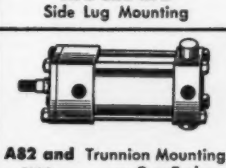


A77 and H77
Side or Foot Mounting

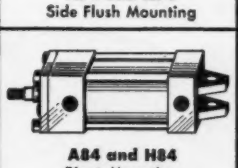


A81 and H81 Trunnion Mounting on Rod End

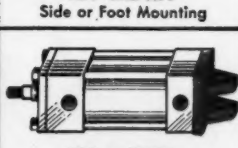
Your Choice of
CAP END CUSHIONED
ROD END CUSHIONED
or
BOTH ENDS CUSHIONED
on all cushioned strokes of all bores shown.



A82 and H82 Trunnion Mounting on Cap End



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

		BORES	ROD DIA.	ROD TURN DOWN & THREADS	"IN-STOCK" STROKES (in Inches)																				
IN STOCK BORES in Inches	AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12								
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12								
		2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
		2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
		5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
					Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

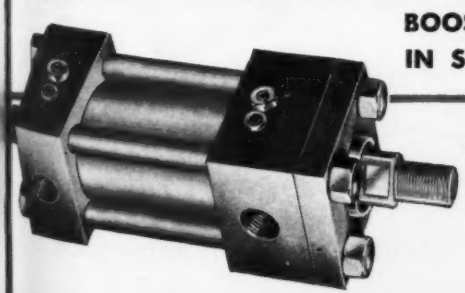
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

Miller

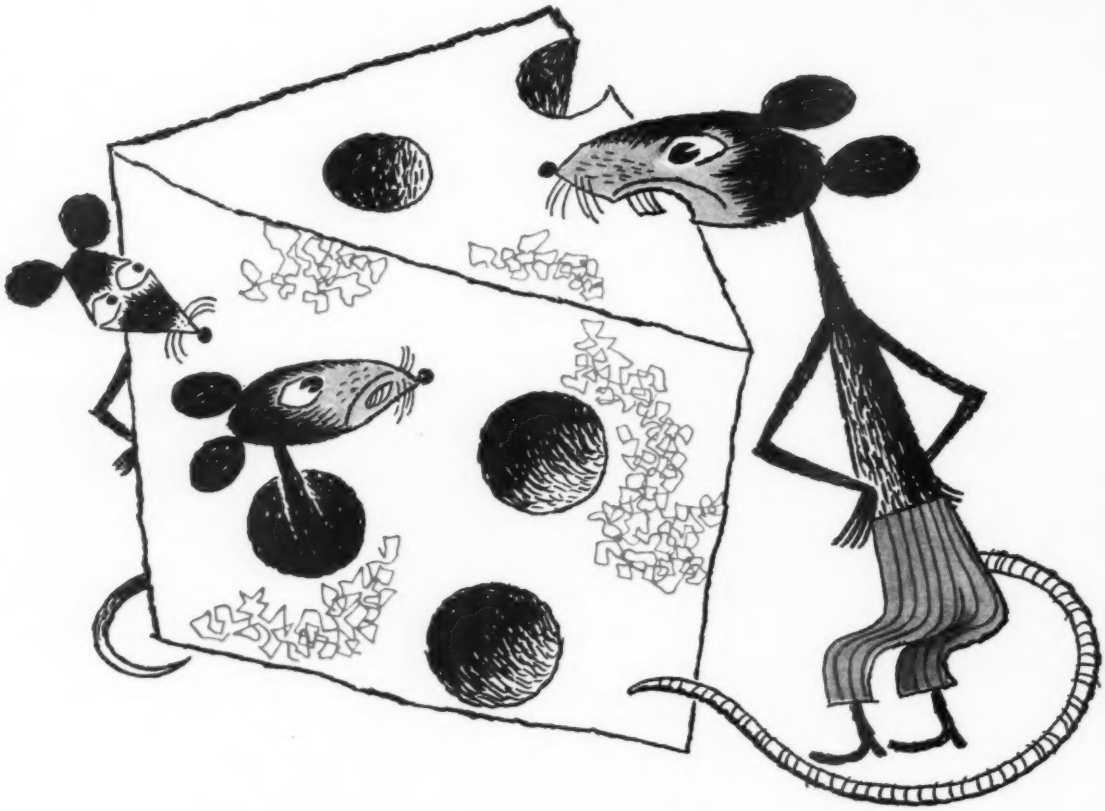
Miller FLUID POWER DIVISION
Flick-Reedy Corp

2046 N. Hawthorne Ave., Melrose Park, Ill.

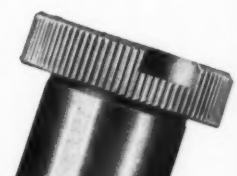
AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

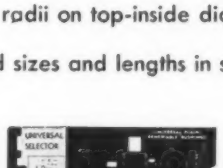
WHAT...

NO UNIVERSAL DRILL BUSHINGS?



Wherever there are holes to drill using jigs or fixtures, it pays to specify Universal drill bushings. Machined from finest quality steel, Universal bushings have super-finished bores which lengthen tool life and reduce bushing wear over long production runs. Knurled heads provide quick, sure grip. Blended radii on top-inside diameters help prevent tool hang-up and breakage. Standard sizes and lengths in stock for immediate delivery.





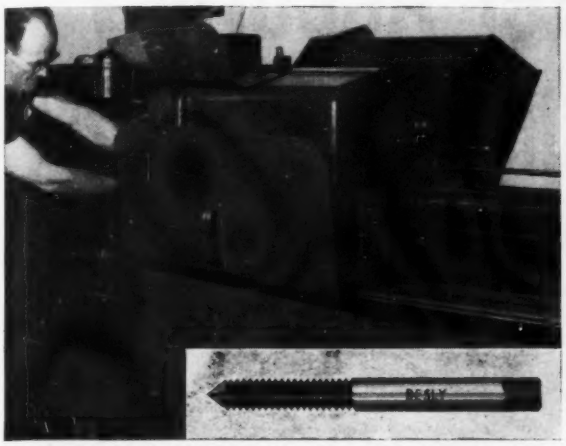
FREE UNIVERSAL SELECTOR. Gives all engineering data for selection of all types and sizes of drill bushings up to 1¾" drill size. Send request on your company letterhead.

196

UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 46

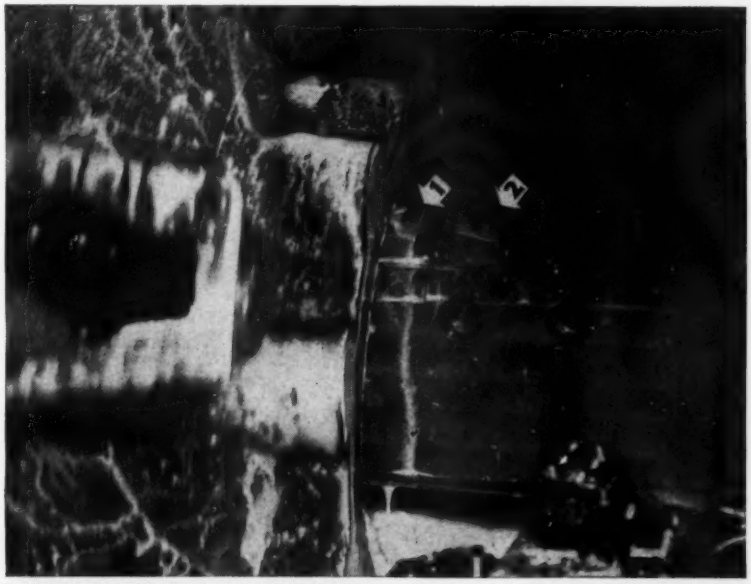
Cutting Tool and Gaging Methods . . . by BESLY



"ROLLING" THREADS IN COPPER—At Steel Industries, Inc., Crawfordsville, Ind., an automatic screw machine is being set up to size, bore and thread 1500 small, difficult-to-tap copper parts per hour. The Besly ¼-28" "X-Press" fluteless tap, shown, is used. H. M. Oshry, Vice-Pres., states, "Besly 'X-Press' Taps made it possible to use this high production method successfully. We get stronger, better, rolled (pressed, not cut) internal threads with no burrs or chips — longer tool life and fewer rejects."

MODIFIED TO FIT—The Gabriel Company, Cleveland, requires two concentric tapped holes in die-cast aluminum pistons used in their airplane type shock absorbers. Originally these were tapped individually — requiring 18 seconds per piece. To reduce this time, a unique set-up using Besly Taps was developed. A smaller Besly Tap is fitted inside the bored-out center of the larger Besly Tap. Two holes are now accurately tapped simultaneously in 9 seconds.

PRECISION ACCURACY—Bodine Electric Co., Chicago, uses Besly-Metro thread plug, thread ring, plain cylindrical plug and ring gages to assure precision accuracy of parts for electrical motor production. Asked why he uses them, A. Wermund, inspection foreman, says, "Last longer — sturdier built."



CARBIDE TOOLS IN ACTION—Cast steel truck wheels made by Gunnite Foundries Corp., Rockford, Illinois, are rough bored with a Besly BL-12-B5 Standard Carbide Tipped Tool, arrow 1, removing ⅛" to ⅜" of stock. On the same turret lathe a second Besly AL-12-B5 Standard Carbide Tipped Tool, arrow 2, semi-finish bores, removing .030" stock. Metal removal is at 200 S.F.M. at .016" feed. Besly's Engineering Service helped to achieve this efficient, low-cost metal removal set-up.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials" . . . are a Besly Specialty

BESLY

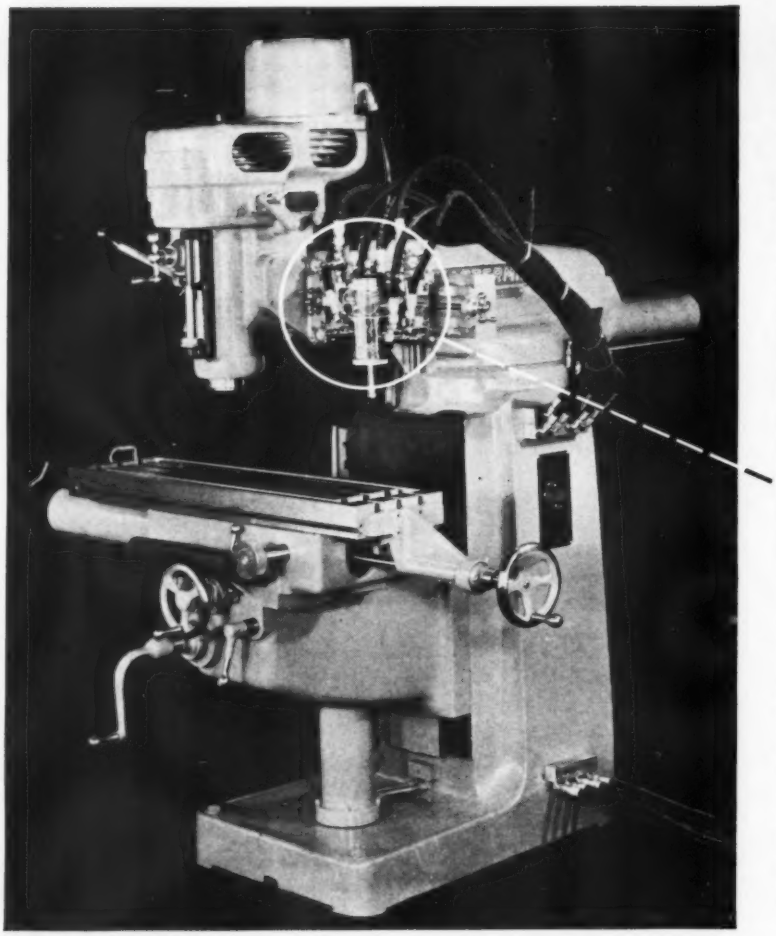
BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
128 Dearborn Ave., South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, TOSS-AWAY INSERTS and HOLDERS

CIRCLE INFORM-A-GRAM KEY NO. 47

Now "Micrometer Accuracy" Applied to Hydraulic Tracer Control

Provides more speed in Production Profiling and Duplicating



Gorton Trace-Master Hydraulic Tracer control is today's best unit for 2- and 3-dimensional duplication, production profiling and work on all types of die forging, die casting, metal stamping, embossing and coining, as well as plastic molds in both ferrous and non-ferrous materials.

GORTON

"TRACE MASTER" Supersensitive Hydraulic Control

This master control valve is manufactured to tolerances which are NEW in the field of hydraulics. Working parts are so delicately ground and lapped that they will operate only with a very fine grade of special oil. *Ordinary hydraulic fluids are wholly unsuitable.*

3 MODELS AVAILABLE

180° Vertical Hydraulic Feed to Knee.

360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table.

3D Hydraulic feed to knee, ram and table for 3-dimensional work.

The above can be furnished with the Gorton 1-22 Mastermil illustrated here or the Gorton 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.

Write for complete information contained in bulletin 2771—1205

GORTON

GEORGE GORTON MACHINE CO.

1205 RACINE STREET • RACINE, WISCONSIN

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1002-1P

CIRCLE INFORM-A-GRAY KEY NO. 48

they're both *two* diameter drills.....

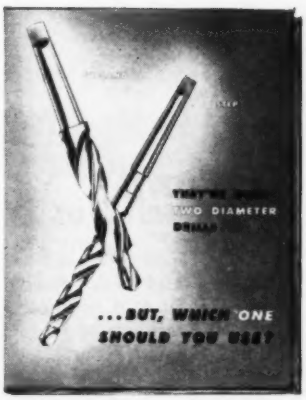
BUT WHICH ONE SHOULD YOU USE?

A *Mohawk* SUBLAND ..... NATURALLY!!

Mohawk Sublands are the modern, practical answer to faster, more accurate and economical drilling of multiple diameter cavities.

One Mohawk Subland drill will outwork and outperform two, three, four or more ordinary step type drills . . . and do the job better.

Why? Because Mohawk Sublands last longer, stay accurate through multiple regrinds and reduce hole costs. They quickly pay for themselves in man hours, equipment and tool dollar savings. And . . . they're available in an amazing range of "off the shelf" size-optional sizes and types.



Facts For Free!

Write, wire or 'phone today for your free copy of the big illustrated brochure Sublands vs Step tool operations. It's yours for the asking . . . and if you're interested in combination drilling operations, you'll find dozens of ways to save your equipment dollars.

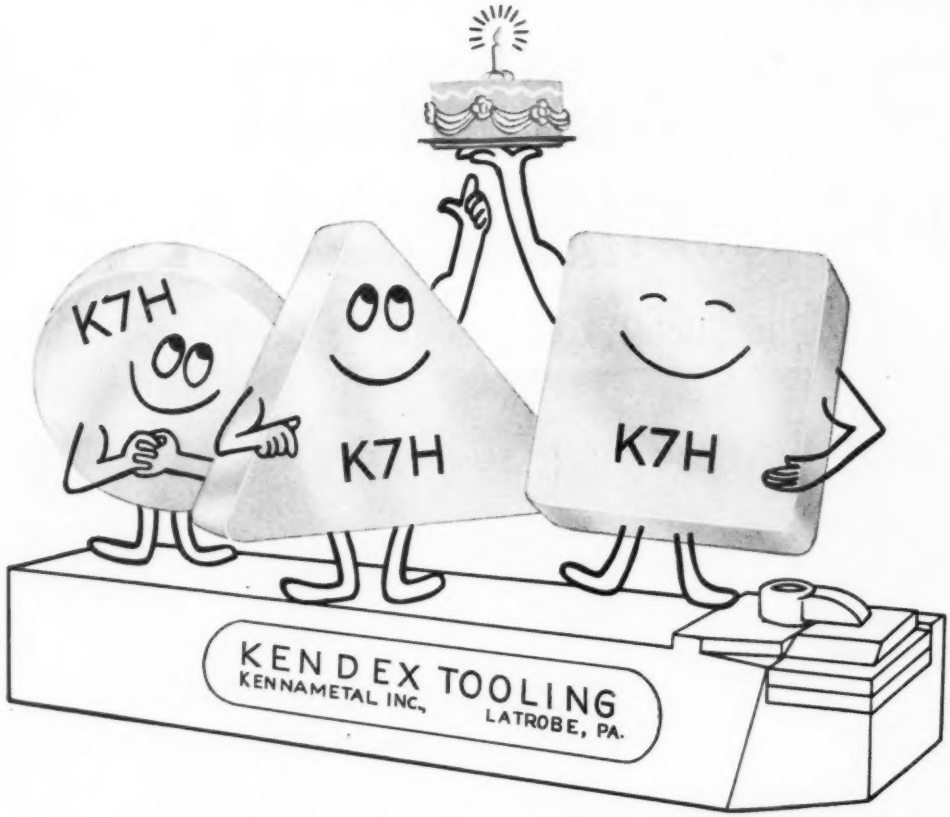
NORMAL DELIVERY ON MOHAWK SIZE-OPTIONAL SUBLANDS TEN DAYS FROM RECEIPT OF ORDER!

world's largest producers of Sublands

Mohawk TOOLS, Inc.

MONTPELIER, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 49



KENNAMETAL* K7H

only a year old but already a champ

After only a year, Kennametal Grade K7H is the proven leader in high velocity machining and in cutting heat-treated and high tensile steels. Its high hardness (93.5 Rockwell A) combined with exceptional strength (three times that of the non-metallics) provides outstanding wear resistance and maximum resistance to cratering . . . high resistance to shock . . . fast cutting and excellent finish.

K7H "throw-away" inserts used with Kendex tooling are improving production and reducing tooling costs over a wide range of applications. Here are a few typical performances:

Production *increased 50%* by substituting K7H on an SAE 8620 forging with a finish cut .060″ deep, 900 sfm, and .018″ feed. K7H machined the same number of pieces per cutting edge as did a competitive carbide at a much slower speed.

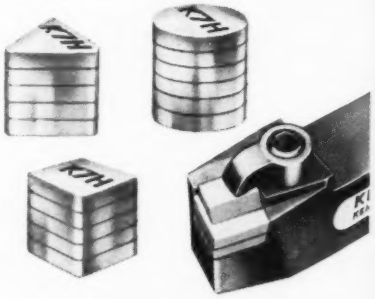
K7H cuts *252 pieces as compared to 30* . . . the best record for a competitive carbide in facing cut to dead center of SAE 1018 steel 5″ O.D. gear blank, at 1000 sfm (at outer edge) and .008″ depth of cut.

In a carbide evaluation test, the lineal footage cut by K7H was *five times* the best footage machined by any of three competitive grades tested . . . and with less than .005″ wear land. Material used: Halcomb 218 steel, 48 Rockwell C, .030″ depth at .010″ feed.

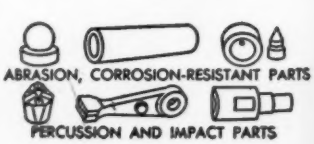
K7H *maintained excellent surface finish* . . . less than 10 microinch finish in cutting 4340 steel at 1000 sfm; 30 to 60 microinch finish in cutting 1095 steel at 1500 sfm.

Try K7H on your hard-to-machine materials and high velocity jobs. A Kennametal tool engineer can help you take advantage of this exceptionally strong Kennametal grade. Discuss your machining problems with him. Or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark C-3033



INDUSTRY AND **KENNAMETAL** ...*Partners in Progress*

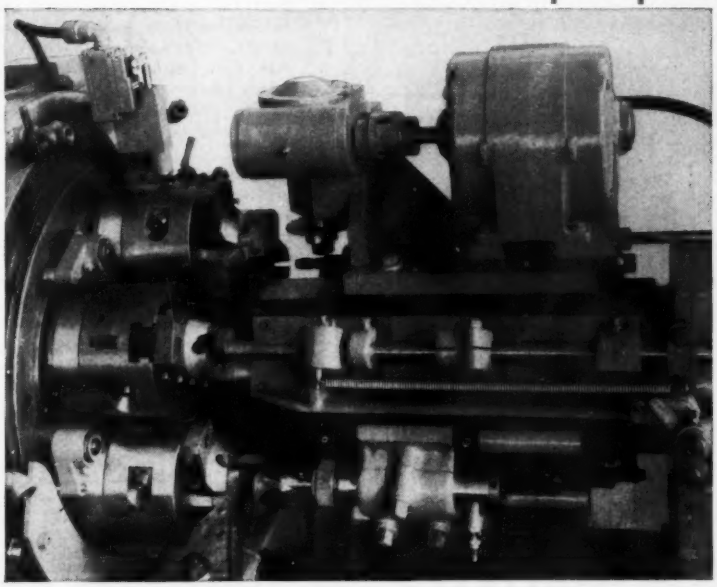


CIRCLE INFORM-A-GRAM KEY NO. 50

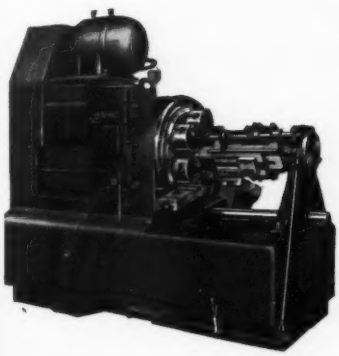
...ask BAIRD about it

DRILL • BORE • REAM • RECESS • FORM RADIUS • MILL SLOT

44.5 seconds per piece



It pays to combine hard-to-handle operations on a versatile BAIRD 76H CHUCKER



industry's most versatile high production chuckers

A glance at this photograph will show you how straightforward and "clean" the arrangement is. Yet a wide variety of operations is being performed to close tolerances on a difficult workpiece.

A unique feature is the milling of the locating slot in the direct center of the part. The milling is accomplished by stopping and accurately locating the chuck. This locating slot is used on all subsequent operations on other machines. The forming of the shape on the lead of the hole, plus the grinding relief, is done by a combination slide with a form tool.

The outer face is machined from the cross slide, which incorporates a relieving motion to eliminate draw-back marks.

Sequence of Operations: Drill, bore and ream .735 - .739 center hole, face end, recess back of center hole for grinding relief, form radius on open end of hole (combination slide), and mill .1875 ± .001 locating slot.

Production: Cycle time 44.5 seconds per piece, 80 pieces per hour gross.

Every manufacturer who has installed Baird Automatic Chuckers knows them as rugged, dependable producers of amazing versatility . . . easy to re-tool when the job changes. We'll be glad to estimate and give our recommendations on your prints or samples. Write **Dept. TP.**

Interested in Deferred Payment? . . . "ask Baird about it."

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC WELDERS • TURNSTILE TURNSTILES

THE BAIRD MACHINE COMPANY

STRATFORD CONNECTICUT

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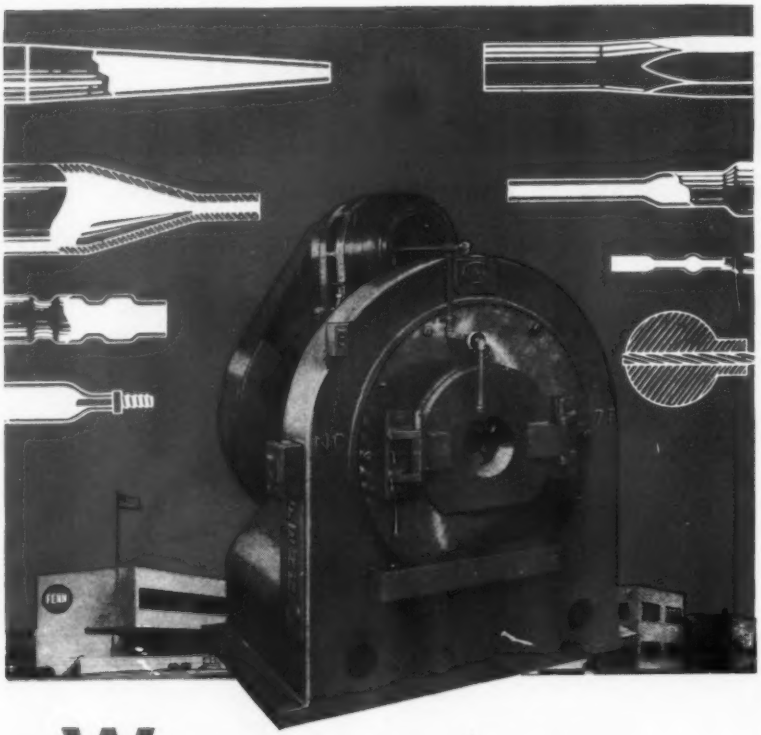
CIRCLE INFORM-A-GRAM KEY NO. 51



What's behind the BOOM to SWAGING?

Plenty . . . in these days of intense competition, higher costs of capital equipment, labor and materials. Cost-conscious production men are finding it far better and cheaper to swage many parts they formerly machined. Fenn's development of the Rotary Swager has produced a dependable, low cost precision production machine for reducing, pointing, tapering, sizing, assembling, bonding and forming ID contours . . . with tolerances to within ± .001. Fenn Swagers are preferred for their compact design, extra heavy one-piece frame that assures rigidity and perfect alignment for long, dependable use at precision standards. A complete range of sizes is available with capacities in solid bar-stock from 5/32 to 3-3/8, and tubing to 6". Fenn also manufactures a full line of manual and automatic feeds and precision swaging dies. To be sure that you are not machining when you should be swaging, send for Fenn's fact-filled Swaging Catalog No. SM56.

FENN ROTARY Swaging Machines

THE FENN MANUFACTURING COMPANY • 202 FENN ROAD • NEWINGTON, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 52

"Commendable Comments"

"The advantages of having a highly automated plant are offset when production specifications and schedules for delivery are buried in a welter of forms. Management needs more precise data with less paperwork if it wants to improve its control over production, keep its customers happy, and maintain its competitive position."

—Robert A. Shiff, management consultant, at manufacturing conference of the American Management Association in Chicago.

Industry must "find the means to do ome fundamental research on its own or subsidize its performance elsewhere . . . The industrial research program should be integrated with the business interests of the company and become as much a part of the continuous operations as is the maintenance of its plant."

—Dr. John T. Rettaliata, president, Illinois Institute of Technology, at an American Management Association meeting in Chicago.

"The direct conversion of steel machining chips into parts is another process which has been improved to the point where it has great potential for future material savings. Techniques have been developed which make this a relatively simple process and the continued rise in steel prices makes the economics of the process even more favorable. The physical properties of parts so made closely approach those made from mill processed steel."

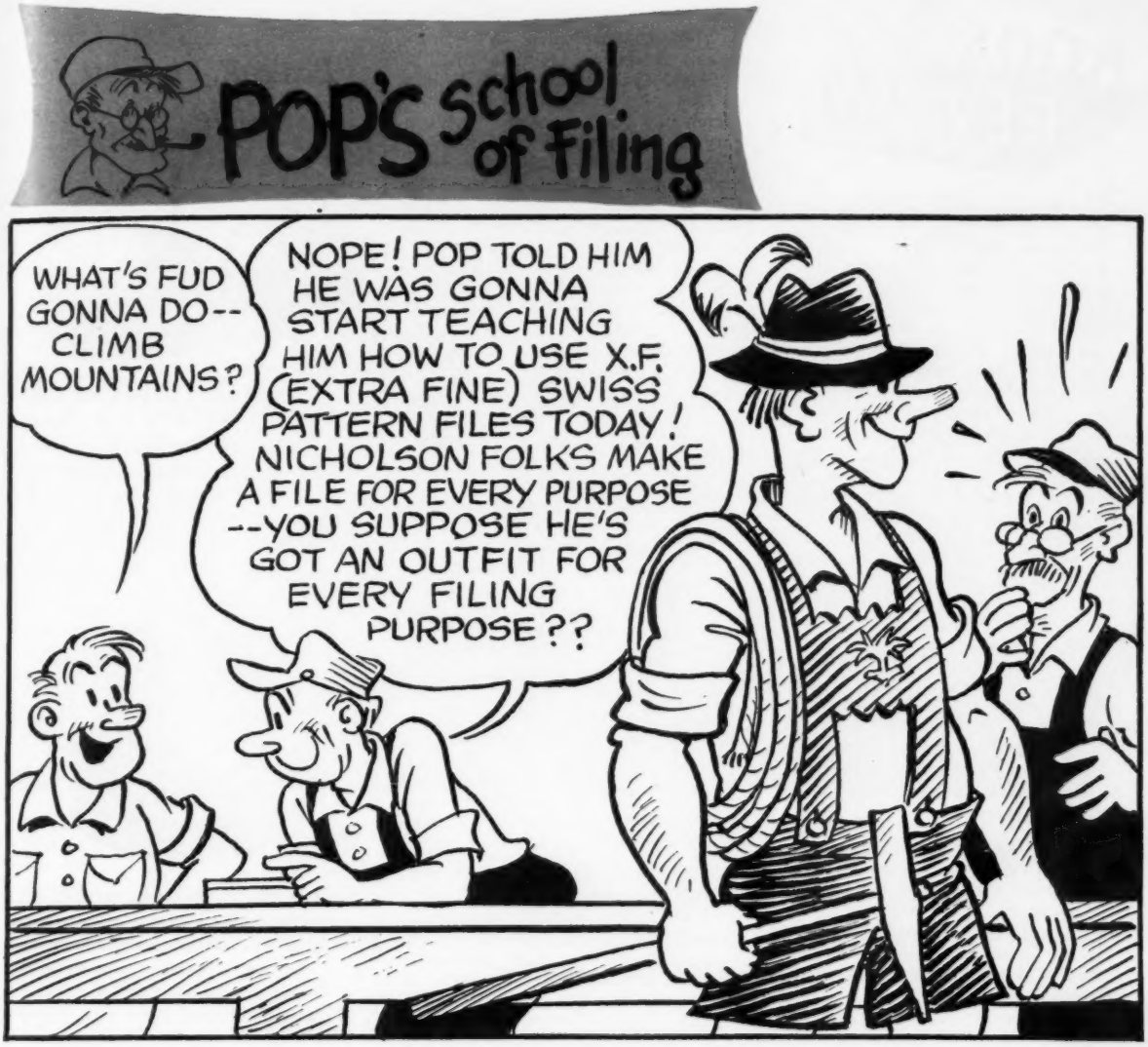
—Glen R. Fitzgerald, chief engineer-automotive, AC Spark Plug Division, General Motors Corp., at the SAE National Production Forum.

". . . search equipment according to the function to be performed by it. Then the student reduces the responsibility to a series of small problems or units. Thus, he is able to learn the circuitry of the machine more rapidly."

—T. G. Cober, director, Customer Engineering, International Business Machines Corp., at the SAE National Production Forum.

". . . in selecting research problems Management's assignment boils down to asking annoying questions and then finding the answers."

—Frank K. Schoenfeld, vice president-research, The B. F. Goodrich Co., at the Cleveland Engineering Society's Design Engineering Conference.


POP'S school of Filing
WHAT'S FUD GONNA DO-- CLIMB MOUNTAINS?
NOPE! POP TOLD HIM HE WAS GONNA START TEACHING HIM HOW TO USE X.F. (EXTRA FINE) SWISS PATTERN FILES TODAY! NICHOLSON FOLKS MAKE A FILE FOR EVERY PURPOSE --YOU SUPPOSE HE'S GOT AN OUTFIT FOR EVERY FILING PURPOSE??

For precision filing and fine work, Fud can forget the leather outfit—and simply equip himself with the proper Nicholson X.F. Swiss Pattern files.

These precision files are made to extremely tight tolerances. And Nicholson makes hundreds of types so that anyone who needs a Swiss Pattern file can get exactly the type he needs with outstanding Nicholson quality.

Nicholson X.F. Swiss Pattern files have the same general shapes as American Pattern files, but you will find them thinner and more finely shaped. You can get Nicholson X.F. Swiss Pattern files in seven degrees of fineness, instead of the usual three for American Pattern files.

Try Nicholson X.F. Swiss Pattern files on your precision work. You'll enjoy using them.

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY, PROVIDENCE, RHODE ISLAND** BLACK DIAMOND U.S.A.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON FILES *A FILE FOR EVERY PURPOSE*

CIRCLE INFORM-A-GRAM KEY NO. 53

MECHANISMS AND DYNAMICS OF MACHINERY, by Hamilton H. Mabie and Fred W. Ocvirk. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., 1957. 442 pages, $8.50.

Greater attention is given to advanced aspects of mechanisms and machinery in this book because of "streamlining" undertaken by the authors. They assume that the reader understands the fundamental physics and calculus relative to the study of the subject.

Part I is devoted to mechanisms, and contains chapters on linkages; cams; spur gears; non-standard spur gears; bevel, helical, and worm gearing; gear trains; an introduction to computing mechanisms; and an introduction to synthesis.

Part II is written from the point of view that relatively few principles are needed to recognize and solve dynamical problems associated with basic types of machines and mechanisms. Chapters cover kinematics of machinery; force analysis of machinery; balance of machinery; and vibration in machines.

MODERN MATHEMATICS FOR THE ENGINEER, edited by Edwin F. Beckenbach, Professor of Mathematics, University of California at Los Angeles. Published by McGraw-Hill Book Co., Inc., New York 36, N. Y., 1956. 514 pages, $7.50.

Representing a broad survey of the application of advanced mathematics to modern technology, this book is the outgrowth of the very successful engineering extension lecture course at UCLA. It contains articles by almost 20 of the mathematicians who helped institute the lecture series.

The book is divided into three parts: The first, "Mathematical Models," dwells successively on physical problems expressed in terms of ordinary differential equations, integral equations, and partial differential equations. Next, in "Probabilistic Problems," are chapters bearing on the programming and operational aspects of engineering and on the use of probabilistic methods in solving problems. Finally, in "Computational Considerations," the emphasis is on numerical solutions. The concluding chapter deals with aspects of high-speed computing devices.

The text emphasizes the importance of stochastical analysis, the theory of games, operations analysis, and linear, non-linear, and dynamic programming in modern engineering.

PLANT LOCATION, by Leonard C. Yaseen. Published by American Research Council, Inc., 2 East Ave., Larchmont, N. Y., 1956. 226 pages, $10.

Scientific plant location involves many factors: raw material sources, information on raw material sources, labor supply, nearness to markets, utilities, taxes, climate, etc. This book does not advocate eliminating any of the factors, but it does tend to guide plant executives in their search for new plant sites. Many check lists, charts, graphs, and illustrations highlight specific points vital to complete, effective site hunting.

ENGLISH-GERMAN AND GERMAN-ENGLISH DICTIONARY FOR THE IRON AND STEEL INDUSTRY, by Eduard L. Kohler. Distributed in the U. S., by Springer Publishing Co., Inc., 44 E. 23 St., New York 10, N. Y., 1955. 330 pages, $6.65.

The words and translations presented in this one volume have, for the most part, been extracted from relatively current scientific and technical literature. For this reason, the author warns that in an attempt to include the most recent developments, terminology in some cases is tentative and probably subject to change. The dictionary can be a valuable addition to the metallurgist's and the metalworking engineer's book shelf, as well as for technical translators.

PROCEEDINGS OF THE 20TH ANNIVERSARY TIME AND MOTION STUDY AND MANAGEMENT CLINIC. Sponsored and published by the Industrial Management Society, 35 E. Wacker Dr., Chicago 1, Ill., 1957. 112 pages, $5.

Complete transcripts of all the talks given at last year's clinic by labor, management, and government leaders on subjects covering time study, motion economy, methods, work simplification, plant layout, production control, wage incentives, maintenance, and job evaluation are included in this paper-bound book.

QUALITY CONTROL FOR PLASTICS ENGINEERS, edited by Lawrence M. Debing and sponsored by the Society of Plastics Engineers, Inc. Published by Reinhold Publishing Corp., New York, 1957. 160 pages, $4.95 ($3.96 to members).

This book introduces Statistical Quality Control to plastics engineers, molders, and fabricators, assuming that the reader has no previous knowledge of the subject. For this reason, SQC is developed simply and clearly to enable those responsible for production of plastics products to use the basic statistical procedures in order to achieve the highest standards of performance.

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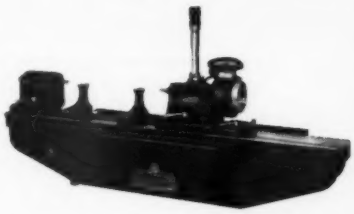

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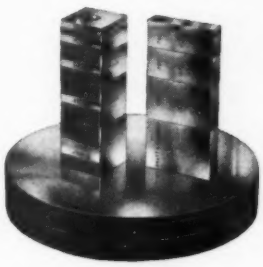

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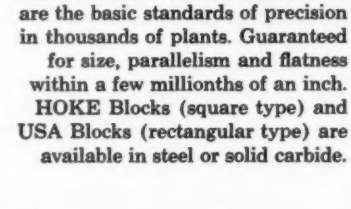

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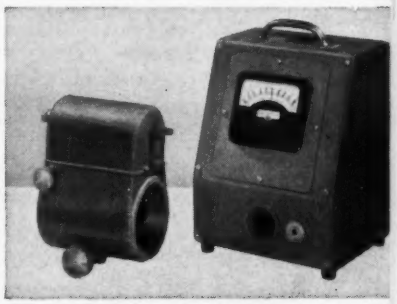

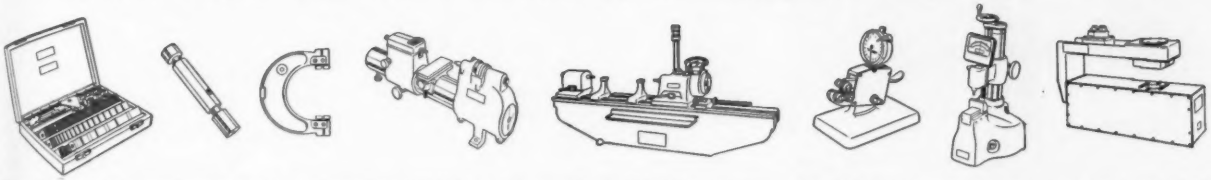

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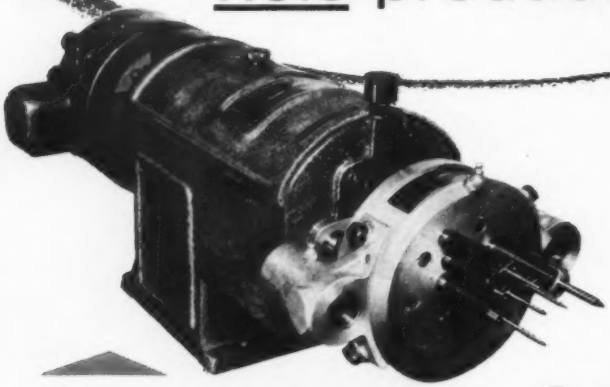

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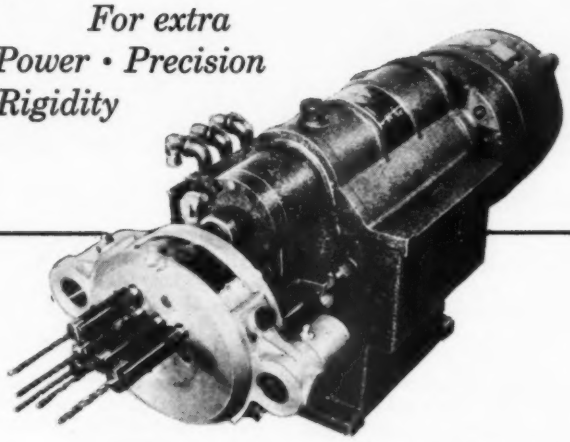

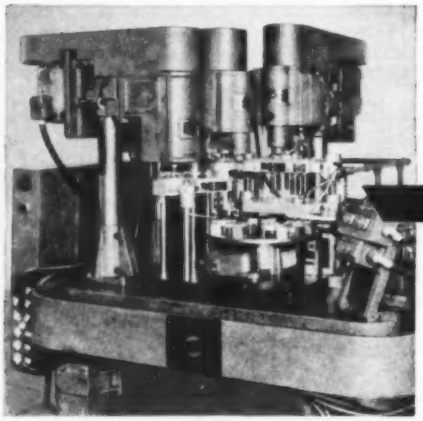

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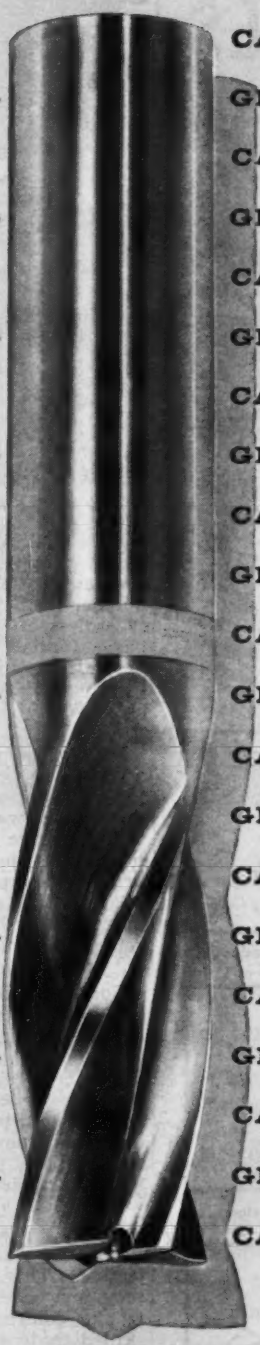

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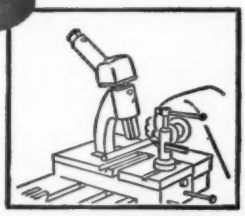

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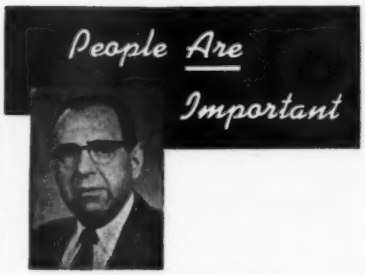

by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

PERFORMANCE EVALUATION AND FOREMAN SELECTION

WHEN FOREMEN ARE SELECTED by up-grading hourly workers, the evaluation of past performance plays a major role. This statement is true regardless of whether the company has a formal "rating plan" or not. Formal rating plans came into vogue shortly after World War I and have had a stormy history ever since. Many of them have taken a terrific beating from both technicians and operating people. Often the criticisms levied at formal rating systems were well-deserved as many of them have been technically unsound and inadequate. Too often emphasis was placed on a rating form in an effort to substitute it for sound judgement rather than to use it as a vehicle by means of which such judgements were communicated.

For the most part, performance evaluations are inherently judgemental. Rating forms and systems cannot make judgements. They can be no more than tools that can help superiors to be more or less uniform with respect to what aspects of the individual they evaluate and to use roughly the same standards as a basis for their evaluations.

When we talk about "objective ratings", we are kidding ourselves. Ratings by their very nature are subjective. This does not mean that they are necessarily useless. Quite to the contrary. In almost every skilled trade and profession, we are frequently dependent upon subjective evaluations as a basis for decisions. Subjective judgements are what the skilled maintenance man uses when he listens to the whirr of the lathe to decide whether or not it's in good adjustment, what the production manager uses in setting up his work schedule for the week,

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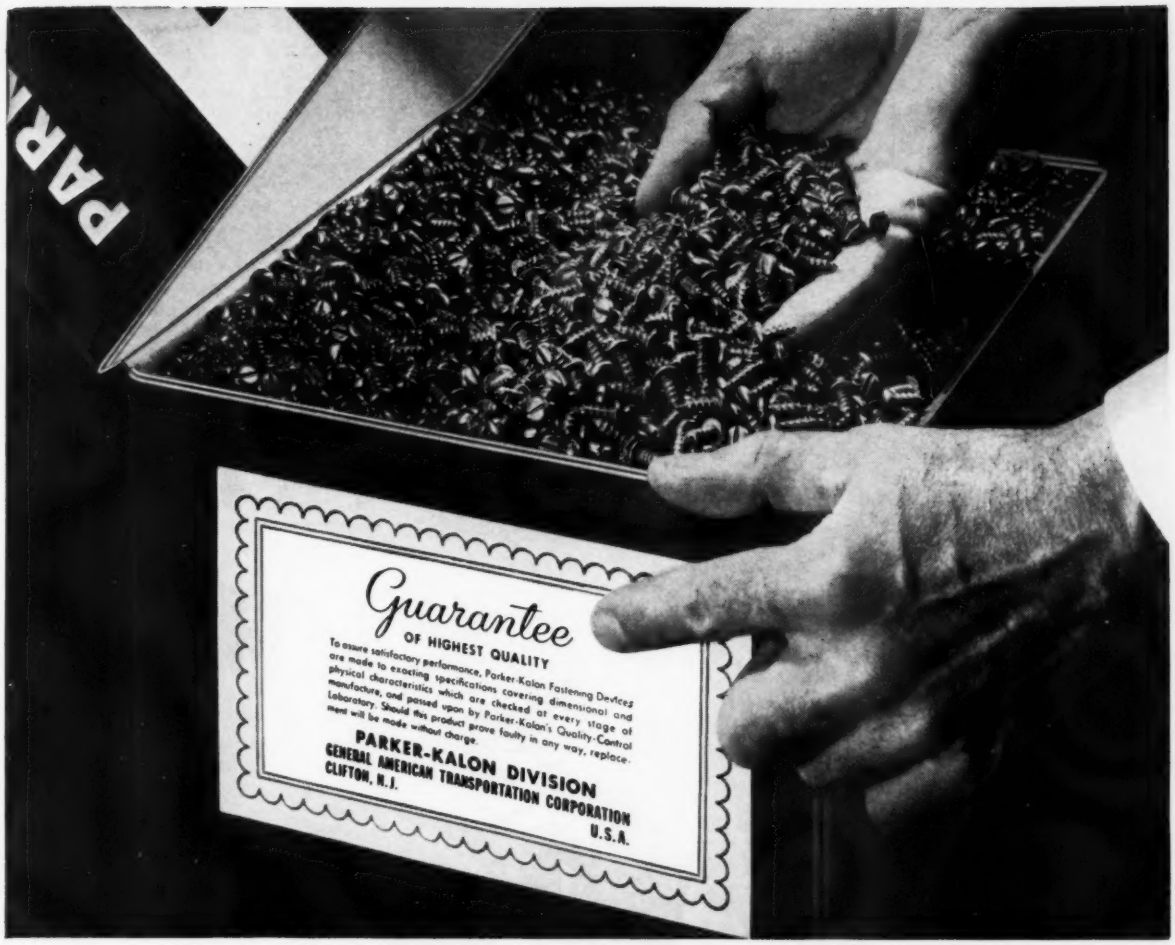
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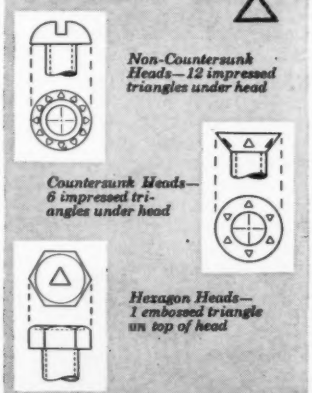

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. . . Performances from page 61

and also for what your wife uses when she decides to add a pinch of salt or a bit more seasoning to the half-cooked stew for tonight's dinner.

No, "subjective judgement" is not a dirty word. If such judgements are made by people trained to make them and they are free of biasing emotional factors, they are an important and necessary part of most of our jobs and the skill that we achieve in making judgements is frequently an important factor in determining how successfully we do our jobs.

The judgements that a superior makes in evaluating the performance of an hourly worker for possible promotion to first-line supervision differs in only three ways from the judgements he makes in deciding which of several different machine tools to use in the processing of a new job, or from the judgement made by the plant manager regarding the advisability of repairing as opposed to replacing a broken-down piece of equipment.

The first difference is that of complexity. The human being is a much more complicated piece of apparatus than even the most elaborate piece of machinery ever devised. A man's work, like the operation of a machine, is subject to a number of natural laws but as yet we have not been able to discover what many of these laws are and how they affect each other. For this reason, we are able in making judgements about human beings to take into account a much smaller proportion of the factors which affect our predictions than is the case in judgements involving only mechanical devices. This means that our batting average is likely to be lower in the field of human judgement than it is in areas not involving human beings.

Secondly, before we are entrusted with important on-the-job judgements, most of us receive special training through formal courses, apprenticeship or understudy in the area of the judgement. Our mistakes usually become apparent shortly after they are made, and those of us who are lucky enough not to get fired for them can learn not to repeat them. In contrast, few factory foremen or shop supervisors have had any formal training commensurate with the complexity of the job in making judgements about subordinates. The errors that they make in this field are much less tangible, and the judge may never be aware of them or may be emotionally unable to accept the fact that he has made them.

Most of us, from the president of the company down, like to think of ourselves as good judges of human nature. In the technical literature

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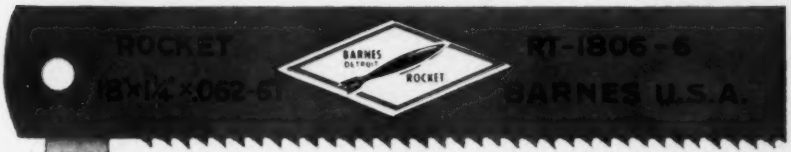

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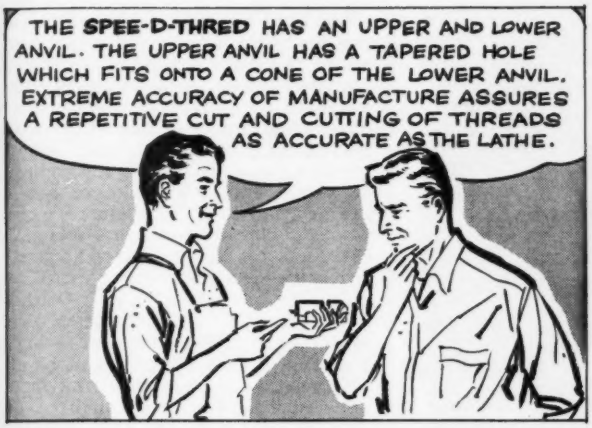
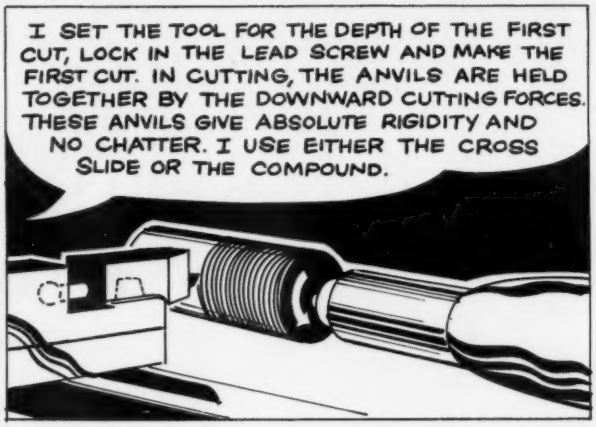
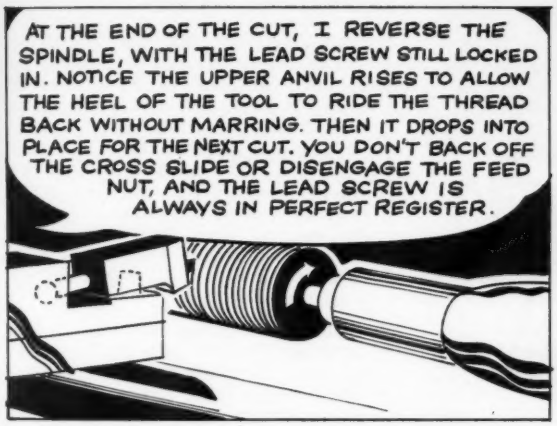
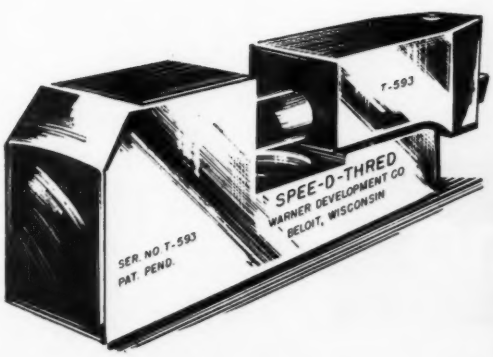
THAT'S EASY, JOE. I USE A SPEE-D-THRED. IT CUTS THREADING TIME 50 TO 70% AND MAINTAINS ACCURACY TOO.


THE SPEE-D-THRED HAS AN UPPER AND LOWER ANVIL. THE UPPER ANVIL HAS A TAPERED HOLE WHICH FITS ONTO A CONE OF THE LOWER ANVIL. EXTREME ACCURACY OF MANUFACTURE ASSURES A REPETITIVE CUT AND CUTTING OF THREADS AS ACCURATE AS THE LATHE.


I SET THE TOOL FOR THE DEPTH OF THE FIRST CUT, LOCK IN THE LEAD SCREW AND MAKE THE FIRST CUT. IN CUTTING, THE ANVILS ARE HELD TOGETHER BY THE DOWNWARD CUTTING FORCES. THESE ANVILS GIVE ABSOLUTE RIGIDITY AND NO CHATTER. I USE EITHER THE CROSS SLIDE OR THE COMPOUND.


AT THE END OF THE CUT, I REVERSE THE SPINDLE, WITH THE LEAD SCREW STILL LOCKED IN. NOTICE THE UPPER ANVIL RISES TO ALLOW THE HEEL OF THE TOOL TO RIDE THE THREAD BACK WITHOUT MARRING. THEN IT DROPS INTO PLACE FOR THE NEXT CUT. YOU DON'T BACK OFF THE CROSS SLIDE OR DISENGAGE THE FEED NUT, AND THE LEAD SCREW IS ALWAYS IN PERFECT REGISTER.

IT SURE SOUNDS EASY AND THE SPEED IS GREAT!
SURE IS JOE, ALL I HAVE TO DO IS REVERSE THE LATHE AND I CAN'T SPOIL ANY WORK FROM CROSS THREADING. NO THREADING DIAL TO WATCH SO I CAN CUT FAST.
WRITE FOR OUR FREE BROCHURE ON SPEE-D-THRED TODAY



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. . . Performances from page 58

in this field, there are numerous well-designed and well-controlled experiments demonstrating that this is not the case. The success of confidence men in rooking the public out of millions of dollars every year, the growing frequency of embezzling, the number of personnel promoted to or hired for management positions only to prove inadequate on the job, yes—even the alarming divorce rate, all give ample additional evidence of how frequently human beings misjudge each other.

It is surprising to discover how many people in this day and age still believe that a worker's characteristics can be discovered by determining the position of the stars on the day of his birth, reading the lines in his palm, and analyzing the number of double consonants in his name. It is surprising too to discover how many people still hang on to specific superstitions about personalities. To many, a receding jaw still denotes a weakness; a receding hair-line, intelligence; big ears, stubbornness; and close-set eyes, shiftiness. A recent issue of *Fortune* magazine devoted an entire article to a system of physiognomy — the evaluation of personal characteristics on the basis of facial features — and pointed out that the president of at least one large manufacturing firm adhered to and believed in this system. Several years ago, *Printer's Ink* published an article supporting the contention that character could be analyzed on the basis of whether or not an individual tended to burn or tan in the sun. It is easy of course to find red-heads who are hot-tempered since some of them undoubtedly are. It would of course be equally easy to find even-tempered or even mousy red-heads. But the devotees of any given system of character-analysis look only for cases that accidentally support their point of view.

The third difference lies in the emotional realm. We obviously do not form the same kind of emotional attachments and antipathies for pieces of equipment that we do for other human beings. It is rare indeed that a foreman would prefer one machine because it was painted red as opposed to another that happened to be green. Yet just such irrelevant factors influence superiors in the evaluation of the performance of their subordinates. There are four cardinal sins in performance evaluations. These are: (1) *Evaluation contamination* — the inclusion in the evaluation of factors which have no bearing on the purpose for which the evaluation is being made; (2) *Evaluation deficiency* — the failure to include in the evaluation all of the factors that are important to the purpose for which the evaluation is being made; (3) *Evaluation*

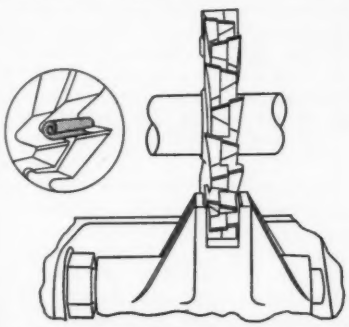
distortion — the assignment of inappropriate emphasis (either too much or too little) to any of the factors in the evaluation; (4) *Evaluation unit inequality* — the use of evaluation scales in which the units of measurement are not equal throughout its length.

Understanding and awareness of these pitfalls in performance evaluation is important regardless of the system of evaluation employed. In the June issue of *Tooling & Production*, we will consider these in more detail and discuss ways in which each can be minimized. end

INTERLOCKING CUTTERS FOR DEEP SLOTTING AT HIGHER SPEEDS, FEEDS

The patented positioning of the teeth in Barber-Colman Co.'s newly-improved line of interlocking staggered-tooth side milling cutters provides that the trailing edge of the leading section is always slightly ahead of the leading edge of the trailing section. This eliminates obstructions to the free flow of chips across the cutting face and thus enables cutting edges to produce more pieces per sharpening.

Absence of chip accumulation, a major cause of tooth breakage, also reduces cutting temperatures. This permits feeds and speeds at a rate which would stall conventional cutters. Depth of cut may be as great as depth of cutter hub without impairing cutting efficiency.



Newly-improved interlocking staggered-tooth milling cutter, developed by Barber-Colman. Circled is a sketch of the chip formation.

The interlocking feature permits the use of shims to accurately keep the cutter at its normal cutting width throughout its life. By varying the thickness of the shims, it is possible to use the same cutter for several widths of slots.

Cutters of this type are recommended for long, deep slotting cuts in steel, for shoulder cuts, and for milling operations where depth of cut exceeds the width of cutting face. They work equally well in steel or soft non-ferrous metals. For complete details, contact Barber-Colman Co., Rockford, Ill., or—**Circle No. D1.**

I-R TORSION BAR TORQUE CONTROL

TORQUE CONTROL IMPACTOOLS
consistently run nuts to prescribed torques

I-R Torsion-Bar Impactools now assure top quality control on these 3 operations:

1. *Assembling differential main bearing caps at 450 ft. lbs.* both before and after machining as shown above.
2. *Preloading differential drive pinion bearing* with Impactools set at 375 ft. lbs.
3. *Assembling wheels to wheel hubs at* 425 ft. lbs.

Quality control has risen to a new high for this large manufacturer of farm equipment since I-R Torsion-Bar Torque Control Impactools were installed.

These Impactools are the *only* power wrenches that deliver full power and speed until the preset torque is reached, and then instantly and automatically shut off.

Now, with Torque Control Impactools, the company consistently runs nuts to prescribed torques, saves time, improves quality and eliminates hand torque checking operations.

Write for Bulletin 5170 for proof of how these amazing Impactools can improve quality and cut costs on your own applications.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

8-524

CIRCLE INFORM-A-GRAM KEY NO. 65

Don't wait for the straw!...

Call Pioneer now...

Why worry about where to find competent designers and engineers of dies, fixtures, tools and gages.

Pioneer has them for you.

Our highly skilled tool designers and engineers are the permanent solution to engineering overloads in many tool and process engineering departments like your own.

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19669 John R Street, Detroit 3, Michigan

INDUSTRIAL ENGINEERS, CONSULTANTS & DESIGNERS
BRANCH OFFICES IN DAYTON, OHIO, WASHINGTON, D. C. and TORONTO, ONT., CAN.

CIRCLE INFORM-A-GRAM KEY NO. 66

Presenting . . . Representing . . .

E. S. Phillips Co. of Pittsburgh, is representing Standard Gage Co., Inc. in the western Pennsylvania and West Virginia areas. The firm will provide assistance for gage application and service needs.

Heppenstall Co., manufacturer of die blocks, steel forgings, industrial knives and materials handling equipment, has named Don E. Williams Co., Moline, Ill., as sales representative for all its products. The firm will represent Heppenstall in Iowa and portions of Illinois and Nebraska. Don E. Williams Co. formerly handled only the sale of knives.

The dealer in Maryland for presses manufactured by Hamilton Division of Baldwin-Lima-Hamilton Corp. is W. E. Shipley Machinery Co. of Philadelphia. Shipley will be responsible for sales of all types and sizes of Hamilton mechanical and Baldwin hydraulic presses, including metal powder and plastics compacting types.

George O. Desautels Co. of Indianapolis is serving as representative for The Hartford Special Machinery Co. The firm distributes the complete Hartford Special line of machines, components, and accessories in the western Kentucky and Indiana area. In addition, Zimmerman and Gaumond, Inc., S. Prospect Park Ridge, Ill., has been appointed representative for the eastern Wisconsin and northern Illinois area.

The Air Gage Division of Dearborn Gage Co. has appointed five new representatives in the Ohio-Indiana territory to handle the sale of Dearbornaire column-type air gage instruments, and air gage elements and accessories. They include The Tool Crib, Inc., Cleveland, Ohio; Walter Cavender, Dayton, Ohio; The Art Kuhn Co., Toledo, Ohio; Charles Brunner, Muncie, Ind.; and Oglesby Supply Co., Louisville, Ky.

Appointment of Allied Precision Components Corp., Mt. Vernon, N. Y., as distributor of hydraulic hose fittings and related specialties has been disclosed by Parker Appliance Co.

Kasle Steel Corp. of Grand Rapids, Mich., has been named as distributor of tool and die steels, high speed steel bars, drill rod, and ground flat stock for Firth Sterling, Inc. Kasle Steel will serve western Michigan industry.

"Gadgeteering"

Kissin' Kin to

AUTOMATION

Webster defines our slang expression "a gadget" as "a device for doing something; especially, a part of machinery." It's kissin' kin to automation.

Many of the marvels in America's production lines are "gadgets" dreamed up by men tired of doing things the hard, slow way.

We manufacture air-powered work units to make the job of the methods engineer easier. With these integrally controlled power units he can eliminate many cams, gears, levers and mechanical linkages and perform an almost unlimited range of repetitive pull, push or lift motions, smoothly, economically, and in perfect synchronization with any related movement. With them he can convert existing machinery into faster, automatic units, or he can build in his own tool room low cost, highly efficient special purpose machines.

Like to know more?

These free four-color booklets will give you a quick picture of what Bellows "Controlled-Air-Power" work units can do for you. Ask for Bulletins BM-25 and ML-3. Address: Dept. TP557, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

The Bellows Co.
AKRON 9, OHIO

MANUFACTURERS OF "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION

7668

CIRCLE INFORM-A-GRAM KEY NO. 67

he HAD to use a sanding block!

but YOU can use a Buckeye Air Tool!

Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, if you're using Buckeye air tools, you can almost forget about tool maintenance.

There was a time when muscle power—and plenty of it—was needed to finish off a smooth surface. Today, air power, directed through a Buckeye tool, has replaced muscle power. The work gets done faster, naturally . . . and better, of course.

We don't imagine you're still using a wood block and emery cloth, but it's just possible you're not using a modern Buckeye air tool. And that's the only way you can be sure you're doing your finishing work the best and most economical way.

Our Catalog A-10 contains complete information on the entire line of Buckeye abrasive tools, all of it both interesting and helpful to all portable tool users. If you don't have a copy, send us your name, company and address and we'll correct that situation promptly.

In Air Tools, Your Best Buy Is Buckeye

Buckeye Tools CORPORATION

DIVISION 19 • DAYTON 1, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 68

Coming Events

Apr. 29-May 3. American Material Handling Society. Seventh National Material Handling Exposition and Conference. Convention Hall, Philadelphia.

Apr. 30-May 1. The Metal Powder Association. Annual Meeting and Metal Powder Show. The Drake Hotel, Chicago.

Apr. 30-May 2. Investment Casting Institute. Annual Spring Meeting. Sheraton Park Hotel, Washington, D. C.

May 1-3. 1957 Electronic Components Symposium. Morrison Hotel, Chicago.

May 1-3. American Institute of Electrical Engineers, Institute of Radio Engineers, Radio-Electronics-Television Manufacturers Association and West Coast Electronic Manufacturers Association. Electronic Components Symposium. Morrison Hotel, Chicago.

May 3. Fourth Annual Conference for Engineers and Architects. College of Engineering. Columbus. Ohio State University.

May 7-12. National Association of Architectural Metal Manufacturers. 19th Annual Convention. Fairmont Hotel, San Francisco.

May 8-11. Fluid Control Institute, Inc. Meeting. Greenbriar, White Sulphur Springs, W. Va.

May 9-10. Conference on Managerial Controls, sponsored by Illinois Institute of Technology. Illinois Tech. Campus, Chicago.

May 12-15. National Industrial Service Association, Inc., Annual Conference. Coliseum, New York City.

May 20-22. Design Engineering Conference. Coliseum, New York City.

May 20-23. American Society of Mechanical Engineers. Design Conference and Design Engineering Show. New York Coliseum.

May 22-24. American Society for Quality Control. 11th Annual Convention. Masonic Temple, Detroit.

May 23-24. Society for the Advancement of Management. Small Business Conference. Hotel Statler, New York City.

May 23-24. Society for Advancement of Management. Small Business Conference. Hotel Statler, New York City.

. . . *Continued on Page 70*

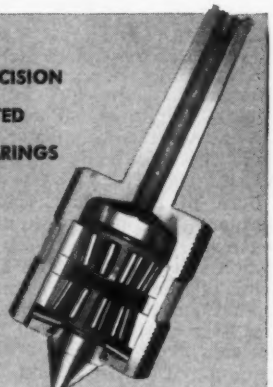
Look for

IDEAL

GOLD BAND

LIVE CENTERS

GUARANTEED TO MATCH, OR EXCEED, "CRITICAL" JOB SPECIFICATIONS



The key to the ultra accuracy of each Ideal Live Center lies in the use of finest precision machined ball and/or roller bearings. Cap is sealed to keep grease in, dirt out. All parts are hardened and precision ground for maximum performance ,and accuracy in lathe use.

Requirements vary from job to job, plant to plant. That's why Ideal makes and stocks over 40 different live center styles and sizes. No matter what your job may be, Ideal has a center to fill your needs exactly. In those rare cases where a "standard" unit won't do, we'll tailor "specials" to your specifications. In 99 out of 100 cases Ideal's Gold Band Live Centers will deliver custom quality performance at production prices.

Ideal Live Centers are stocked by leading industrial distributors. Look for the one in your area, or, write directly to us. In either case, you're assured prompt service and satisfaction.

A COMPLETE LINE FOR EVERY NEED . . . SPECIALS TOO!

UNIVERSAL Super accurate model

MULTI DUTY General duty model

HEAVY DUTY For extra-rugged operations

PIPE POINT For cylindrical turning

Send for

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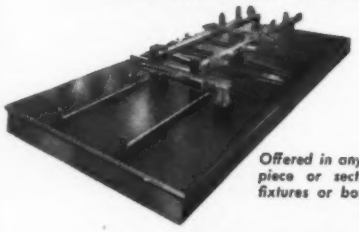
Today's Standard in Precision Surfaces

MACHINE PRODUCTS

SURFACE PLATES . . . Specially heat treated cast iron to eliminate distortion and to insure dimensional accuracy . . . triangular rib supported to resist load deflection . . . finished to exacting precision specifications . . . ample top thickness to permit resurfacing operations.

Standard sizes from 7 x 7½ to 72 x 168. Extra large and heavy duty plates also available.

FLOOR PLATES . . . May be utilized for either layout or fixtures . . . features an adjustability of .002" in any direction . . . offers the convenience of 2" clamping ledges on both sides and ends. And, if desired, cast iron plates can be furnished with machined scribed lines.



Offered in any size up to 10' x 20' in one piece or sections. Quotations on plates, fixtures or both furnished on request.

LAYOUT PLATES . . . Designed to facilitate layout work . . . flawlessly surfaced to meet today's precise requirements in inspection . . . ruggedly constructed to permit mounting of unit heads for machining operations.

Standard sizes: 36 x 72, 36 x 96, 36 x 150. Other sizes on request.

Facilities also available to recondition worn equipment to your "specs."

Free! Catalog containing descriptions, specifications on Machine Products plates and accessories.

MACHINE PRODUCTS *Corporation*

6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 70

. . . Events from page 68

June 5-7. Bureau of Apprenticeship & Training, U. S. Department of Labor. Apprenticeship Conference. York Harbor, Me.

•

June 9-13. International Automation Conference and Exposition. Coliseum, New York City.

•

June 9-13. Military Automation Exposition. Trade Show Building, New York City.

•

June 9-14. Pennsylvania State University. Third Annual Automation Seminar. University Park, Pa.

•

June 10-11. Radio-Electronics-Television Manufacturers Association. Symposium on Applied Reliability. Hotel Syracuse, Syracuse, N. Y.

•

June 11-13. Third Western Plant Maintenance & Engineering Conference and Show. Civic Auditorium, San Francisco.

•

June 11-14. Cornell University. Annual Industrial Engineering Seminars. Ithaca, N. Y.

•

June 13-14. Society for Advancement of Management. Material Handling Conference. Statler Hotel, New York City.

•

June 14. Pressed Metal Institute. Second Annual National Sales Conference. Hotel Carter, Cleveland.

•

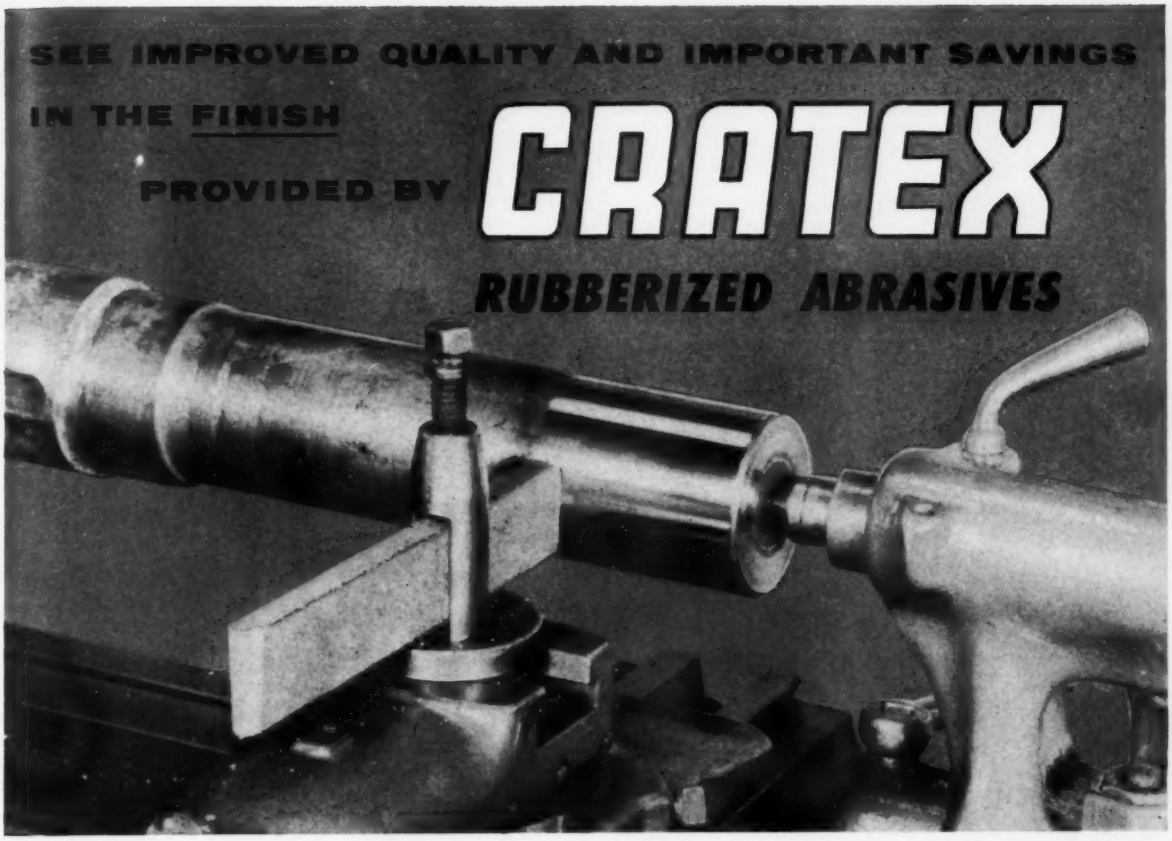
June 17-21. American Society for Engineering Education. Annual Meeting. Cornell University, Ithaca, N. Y.

DIAMOND EXPERT PAUL GRODZINSKI DIES IN ENGLAND

Dr. Paul Grodzinski, founder of the *Industrial Diamond Review*, author of the comprehensive book "Diamond Technology" and a considerable number of other technical works, and inventor, died at his London, England, home in February. He was 56.

Born in Berlin and schooled in Germany, his interest in diamonds began in 1926, largely through association as consultant with Winter & Sohn of Hamburg. He moved to England in 1938 and published the first issue of the *Industrial Diamond Review* there in 1940. From its founding, Dr. Grodzinski was its technical editor.

After becoming associated with the Diamond Corporation as head of its Industrial Diamond Information Bureau, Dr. Grodzinski later took over the responsibilities for publishing of *The Bibliography of Industrial Diamond Applications*. His most current work was a bibliographical journal called *Mechanisms*, which he was working on at the time of his death.



MILK PROCESSING EQUIPMENT

Polishing hard to reach spots on stainless steel with grinding wheels and emery paper proved too slow with poor results. Cratex cones Nos. 1340-C, 1359-C, 1340-M and 1359-M produced a highly polished, scratch-free surface much faster. Easy cleaning and less danger of bacterial contamination resulted.

Field Application Report #121

CAST IRON PLASTIC MOLDS

Final finishing of molds for glass reinforced plastic articles was unsatisfactory for efficient pressure molding and product appearance. Cratex 112-M and 216-M wheels and 1358-M cones produced the required fine finish and greatly reduced or eliminated finishing on molded articles and improved product appearance.

Field Application Report #115

In virtually every metal working operation where a high degree of surface smoothness is required, Cratex Rubberized Abrasives lower costs and improve quality. They are used successfully on hard and soft metals . . . for deburring, smoothing and polishing . . . in tool and die shops . . . on production lines . . . and in the full range of machined and fabricated metal products.

Use Cratex to replace many slow, hand operations, to increase dimensional control, and to eliminate many multi-step operations. Cratex lowers costs, saves time and rejects because it finishes faster, more smoothly, and with minimum danger to tolerances. Order Cratex in Wheels, Points, Blocks, Sticks or Cones—in four grit textures.

TEST CRATEX IN YOUR OWN PLANT
WITH THIS NEW POLISHING KIT
24 ITEMS FOR ONLY $12.50

Wheels, Blocks and Cones in a variety of grit textures, to demonstrate how CRATEX can save you money and improve quality in your own operations.

☐ Here is our P. O. for the CRATEX Polishing Kit, at $12.50 (Will be sent thru industrial distributor in your area)

☐ Please send complete CRATEX catalog (Free)

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Company_____

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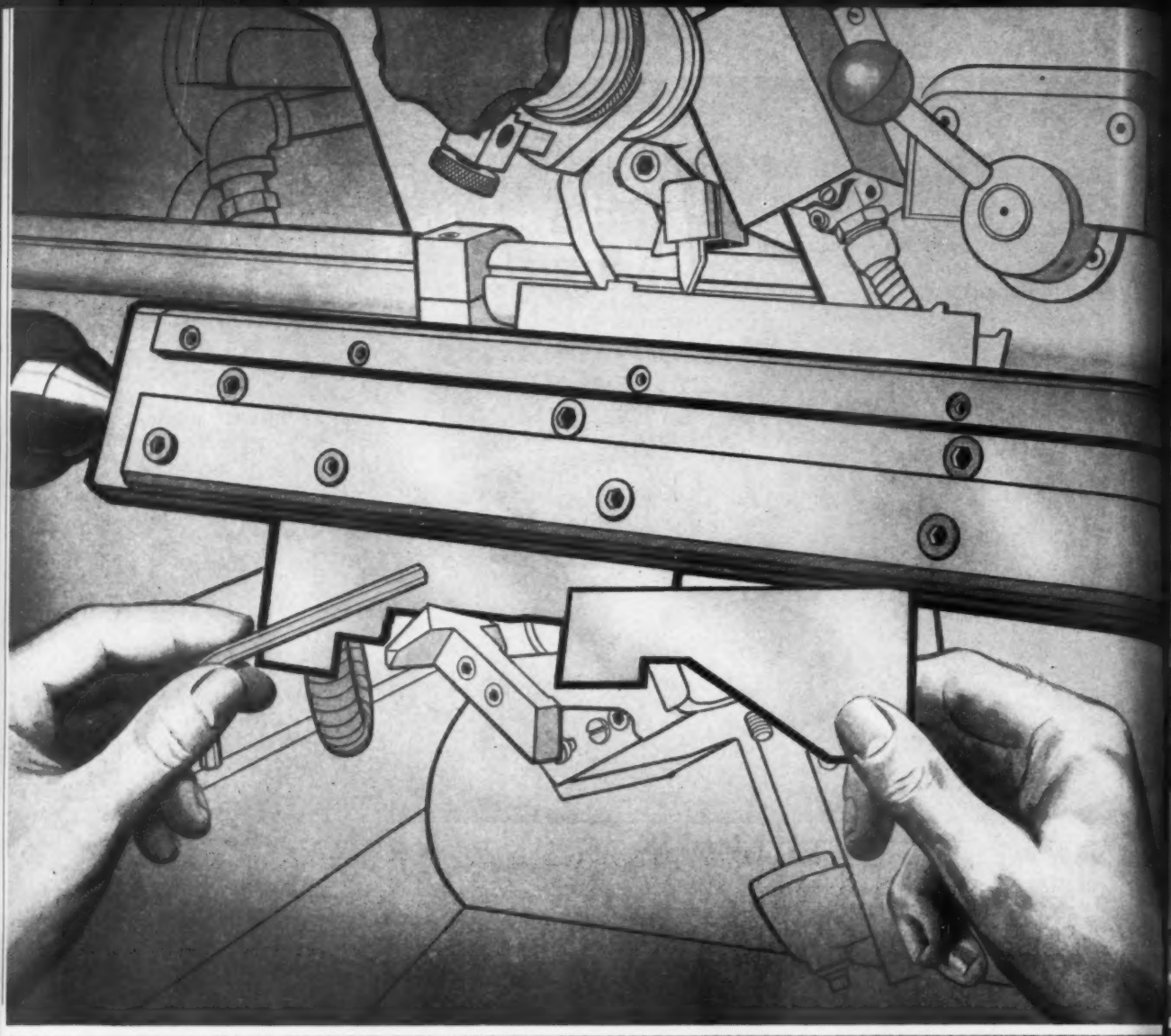
CRATEX MANUFACTURING CO.
81 Natoma St., San Francisco 5, Calif.

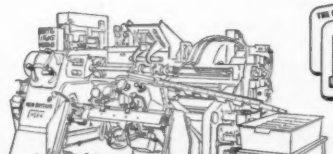
CIRCLE INFORM-A-GRAM KEY NO. 71



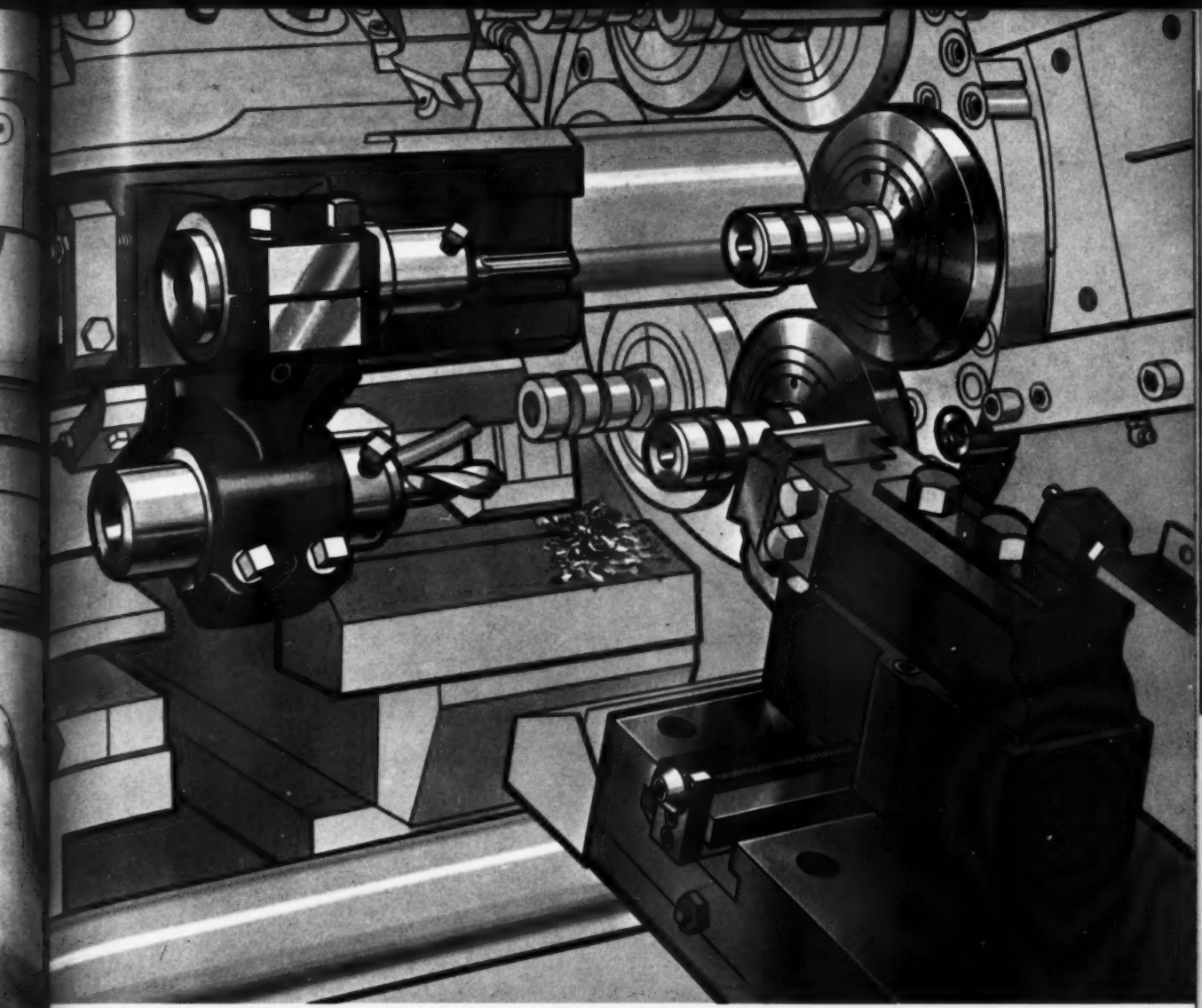
template control "locks in your dimensions"

on New Britain +GF+ copying lathes

When you fasten the template on a New Britain +GF+ you lock in every dimension of the piece. The complex settings necessary in gang tooling setups simply don't exist. You change the tool in the time it takes to loosen one set screw. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

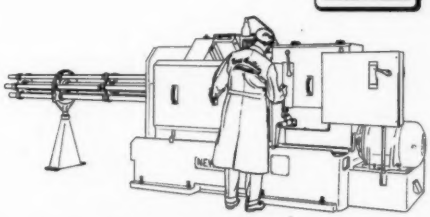


New Britain +GF+ Copying Lathe

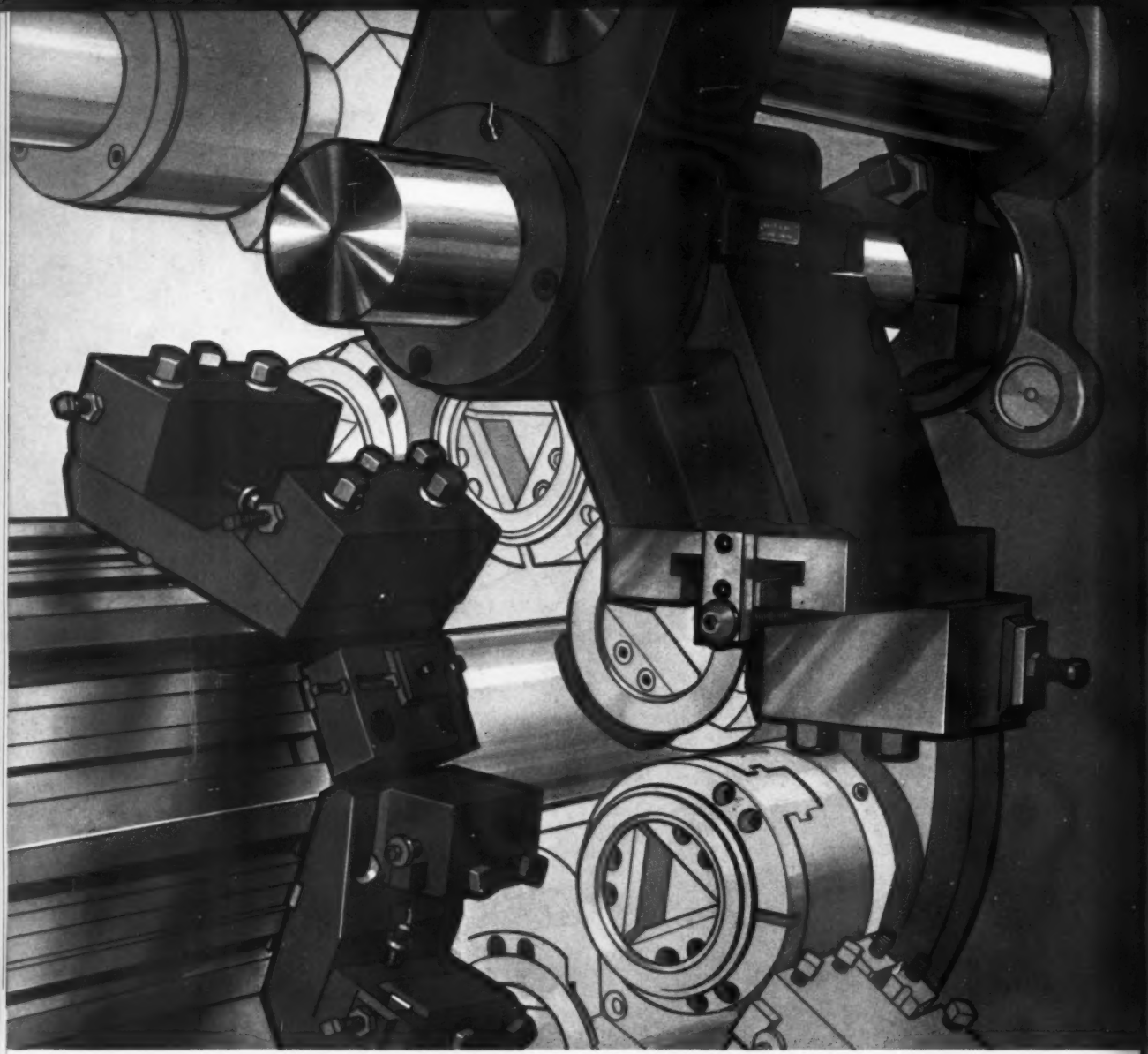


less wear means more profit

New Britain bar machines are "built to stay accurate." Hardened spindle nose cross slides, eccentric cross slide stop buttons and tool slides, plus carrier lifting during index, are only a few of many *exclusive* New Britain features for preserving long-run accuracy. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



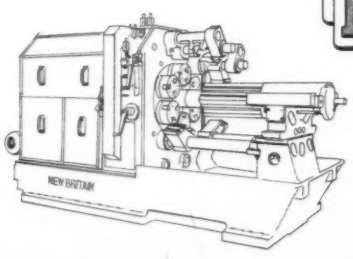
Automatic Bar Machine



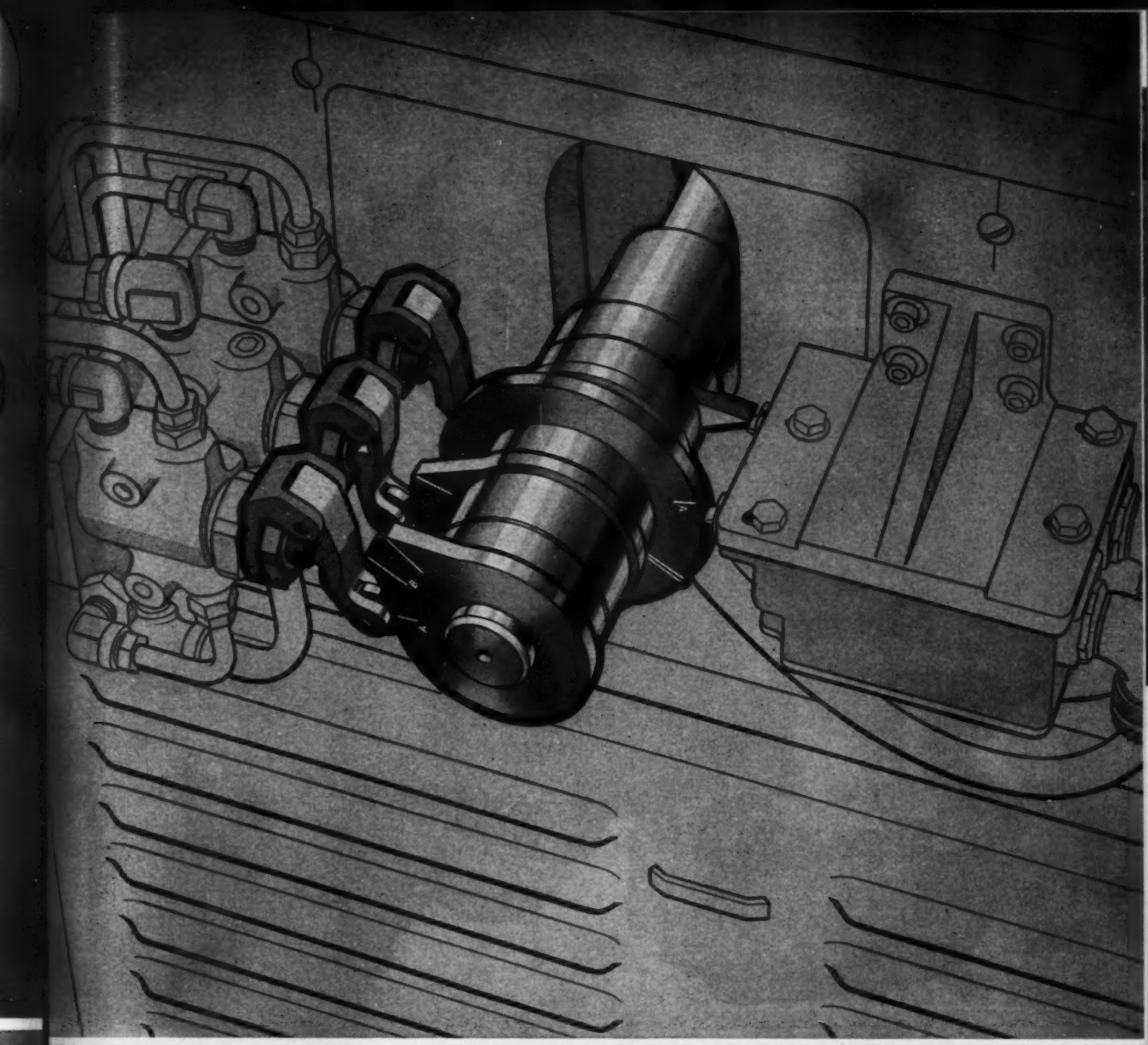
when the job calls for a big, husky chucker

pick a New Britain

New Britains are massive, not only in over-all size and weight, but in every individual feature. Rugged forming arms and tool slides transmit smooth power to the cutting edge in every position. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine



New Britain boring machines feature exclusive mechanical program control

This New Britain feature means *positive control* which, in turn, means fewer mistakes, fewer rejects, and fully automatic operation, if desirable. Geared to the main cam shaft, it operates the sequence of operations, both electrical and pneumatic.

Combined with positive, accurate cam control of the tool slides, mechanical program control makes a New Britain boring machine your most dependable, accurate, and profitable investment for straight or contour boring and turning. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

Precision Boring Machine

CIRCLE INFORM-A-GRAM KEY NO. 75

NEW

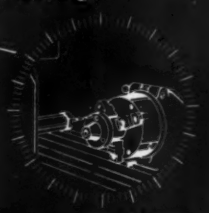
ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in

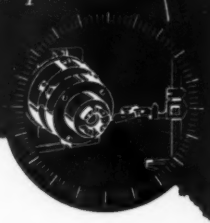
straddle milling



milling

jig drilling
with either micrometer or "Jo" block setting

inspection



Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-3091

ERICKSON TOOL COMPANY

2301-5 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

CIRCLE INFORM-A-GRAM KEY NO. 76

guest editorial:

"The Million-Dollar Lathe"

THE PLAIN DEALER

The Plain Dealer, established as a weekly in 1842, became a daily evening paper in 1845. Morning and Sunday Editions founded in 1885 by L. E. Holden.

Published Daily and Sunday by

The Forest City Publishing Company

1801 Superior Avenue N. E., Cleveland 14, Ohio

STERLING E. GRAHAM
President

CHARLES F. McCAHILL
Senior Vice-President

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Vice-President and Business Manager

WRIGHT BRYAN, Editor

Net paid circulation for twelve months ended September 30, 1956:

Daily 306,139 Sunday 530,977

MONDAY, MARCH 11, 1957

Ralph Donaldson, Chief Editorial Writer for THE PLAIN DEALER, Cleveland's morning paper, came up with this editorial a few days ago which we wholeheartedly commend to the attention of each and every one who benefits from our free enterprise system. Obviously, it becomes a little less free when one lathe can cost a million dollars. Here's how:

Thompson Products, for the 18th year, has continued its commendable custom of furnishing its employees with a simple concise report of its financial operation showing how much money the company took in and what happened to it.

The income for 1956 totaled $306,508,120. Expenses, not including wages, salaries or dividends, were $175,353,061, leaving $130,973,059 to be divided among employees and stockholders. Of this, $117,960,454 went for payrolls, $4,193,904 was paid out in dividends and $8,828,701 was plowed back into the business.

Why was it necessary to plow that much back into the business? The tale of the million-dollar turret lathe, included in the report, explains that.

It seems that in 1942 the company bought a lathe for $12,000. Under federal tax laws, it was permitted to depreciate the cost of the lathe over a 14-year period. So, last year when the lathe became obsolete, the company had $12,000 to buy a new one, plus $1,000, which was the resale value of the old one. The story continues:

"But the replacement cost in 1956 was $35,000 for a lathe that would perform the same functions as the old model, or $67,000 for a new one with attachments to meet today's more exacting needs.

"The company had only $13,000 to do a $67,000 job. The difference of $54,000 had to come out of profits, and in order to get that amount in 1956 the company had to earn a profit of more than $112,500 before taxes, because $54,000 was all there was left after the government took its corporate profit tax of 52%.

"And to earn that amount of profit, the company had to sell more than a million and a quarter dollars worth of products to customers. It took more than $1,250,000 of sales to buy just one machine!

"Thus, while $112,500 sounds like a lot of profit, in this case, the stockholders got none of it. The government took more than half, and the rest went to replace a machine so three Thompson people — one per shift — could continue working.

"This story is duplicated hundreds of times each year throughout the company in the case of machines, large and small. This is why only a relatively small amount of profit is paid to stockholders in dividends, and why a large portion must be retained to finance expansion and replacement so the company can continue to operate and employees can continue working."

This is something to think about when agitators scream about high corporate profits. No profits, no new machines, no jobs.

TOOLING & PRODUCTION Magazine

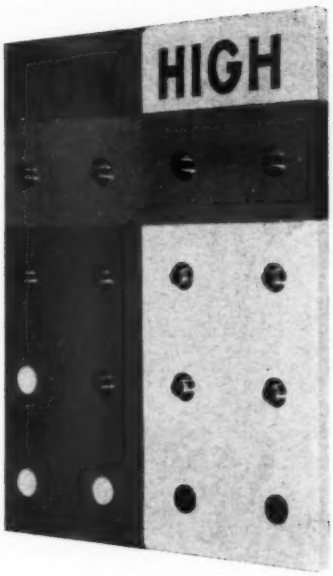

Fig. 1. An 8 & 2 board based on 0.95 probability. See also front cover illustration of this board "at work."

PEG-BOARD Q-C

by Ralph B. Nottingham
Manager, Quality Control Dept.
BRUSH ELECTRONICS COMPANY
Cleveland, Ohio

Here is a quality control technique, devised by Mr. Nottingham, that is far simpler than a $300,000 computer. All you need is a piece of plywood, an auger bit and brace, and some red, white, and green paint, and you're in business! Paradoxically, the method is so simple that it takes quite a bit of detailed explanation. We are sure that our readers will join us in appreciation to Brush Electronics and Ralph Nottingham for disclosing the development of this effective, inexpensive, and fast-working Q-C tool.

MOST EVERYONE who is well informed in quality control agrees that the primary responsibility for quality lies with the production organization. However, many of our quality control techniques are so complex and so time-consuming that it is not feasible to delegate their execution to the production operator. There are techniques which are not frequently used which are completely suitable for use by production.

It is usually not practical for an operator to maintain an $\bar{x}$ & R chart. First, he may not have sufficient time to make the necessary entries and calculations. Second, he may not be capable of doing the required calculations. Third, an operator whose hands are covered with oil is not in a position to do paper work. Therefore, such charts are usually maintained by a patrol inspector.

One obvious disadvantage of patrol inspection is that it is periodic, and if a shift in the process accuracy occurs immediately after an inspection, half an hour or more of production may be scrapped before the shift is discovered.

It, therefore, is desirable to provide a continuous surveillance of the operation, if this can be done without decreasing the operator's productivity.

There is one method which lends itself well to the solution of this problem. We will call it the Zero Center Method. (We call it "Peg-Board Q-C!" — Ed.) This procedure is acceptable only where the process capability is well within the tolerance but resetting is required due to tool wear. An example may be that of a grinder which has to be reset periodically to allow for wear of the grinding wheel. We wish to prevent unnecessary resetting, but we must be sure that resetting is done whenever the wheel wear warrants. It is clear that, when the process is set exactly on the nominal, an equal number of parts will be high and low. However, if the process shifts by as much as one standard deviation of the process variability, parts will begin to pile up on one side of the nominal.

For example, if we have 8 parts below the nominal and 2 above, we have 0.95 probability that the process center has shifted by at least one-third of the process capability. This method involves only having a gage supplied to the operator which is set exactly to the nominal for the dimension under control. The operator then gages each piece, or at specified intervals, and sorts the parts into two groups: those which are above and those which are below the nominal.

The actual operation of this type of an inspection can be done by means of a marked board or "plywood chart" where the parts are placed and which shows, by painted areas, when an unbalance has occurred. The board has drilled holes or pockets of a size to comfortably accommodate the workpieces.

In the example illustrated, Figure 1, we have a board with 8 holes in both the "low" or "high" sides. The first, or top, 2 of each 8 holes are in a red area. All pieces which gage above the nominal are placed on the high or white side of the board, and all those gaged below the nominal on the low side which is green. As soon as the operator fills either side of the board, he looks at the other side to determine whether or not he has gotten "out of the red." In other words, if when the high side of the board is full he has 0, 1, or 2 pieces on the low side, he is still in the red and his process should be reset. If he has more than 2 pieces, the process should continue to operate. In either event, he puts the parts in his tote pan and again starts filling the board as the pieces come from the machine.

To repeat, the example we have shown uses 8 pieces as the sample size, which is the quantity necessary to fill one side of the board (high or low).

The number of pieces which have meanwhile accumulated on the other side of the board renders the decision as to whether or not to reset.

Two (pieces) is the critical number because: after either side of the board is filled with 8 pieces, if the opposite half of the board has 0, 1, or 2 pieces, that half of the board is not loaded beyond the red area; its pieces are still "in the red" and the machine should be reset.

Whereas, if there are more than 2 pieces on the unfilled side of the board, the operator continues without resetting.

It should be noted that in loading each half of the board as the pieces come off the machine and are gaged, the loading of the "high" and "low" gaged pieces starts at the upper left hand pocket in the respective halves of the board.

Referring to our front cover illustration, the operator has 6 pieces in the "high" side of the board. He is placing a 3rd piece in the "low" side of the board; hence he is "out of the red" and into the green. And, relative to the "high" or white half of the board, he is also out of the

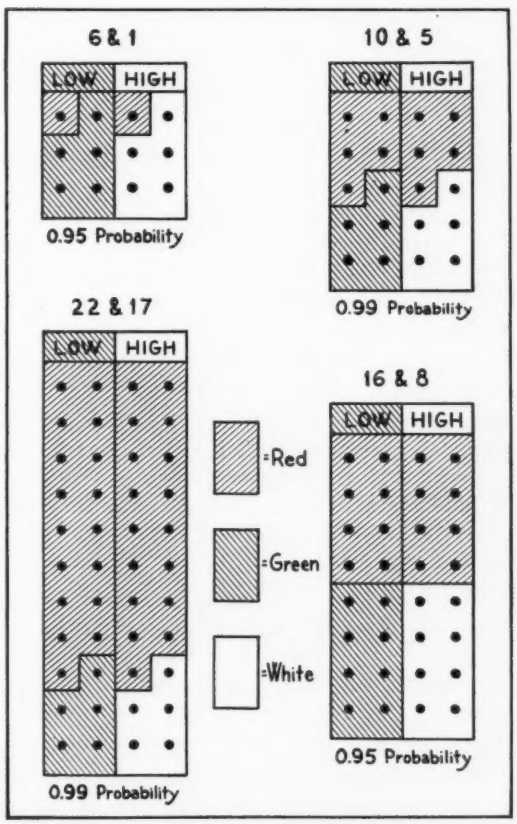

Fig. 2. Examples of four board layouts constructed from the data in Table I.

red and into the white. So, regardless of which half becomes filled first, the process is under control. He then dumps the pieces into his tote pan and again starts loading the board according to the dictates (high or low) of his nominal-set gage.

Our "Peg-Board Q-C" system has extreme flexibility and can be devised to handle larger sample sizes and other probabilities than 0.95.

Table I shows a great range of sample sizes, from 4 to 24, and for probabilities of both 0.95 and 0.99.

TABLE I

Probability 0.95	Probability 0.99
6 & 1*	4 & 1
8 & 2	5 & 1
9 & 3	6 & 2
8 & 2**	10 & 5*
9 & 3	11 & 6
11 & 4	12 & 7
12 & 5	13 & 8
13 & 6	14 & 9
14 & 7	15 & 10
15 & 7	16 & 11
15 & 8	17 & 12
16 & 8*	18 & 13
17 & 9	18 & 14
18 & 10	19 & 14
19 & 11	19 & 15
20 & 12*	20 & 15
21 & 12	20 & 16
21 & 13	21 & 16
22 & 13	21 & 17
22 & 14	22 & 17*
23 & 14	
23 & 15	
24 & 15	

*See Figure 2 **See Front Cover

Relative to the pairs of numbers shown, 6 & 1, 17 & 11, etc., the left hand figure is the sample size and to its right is the critical figure. In the left hand column, we have a 0.95 probability that the process has deviated by more than one standard deviation. In the right hand column the probability is 0.99.

Figure 2 shows four sample board layouts for 6, 10, 16, and 22 sample sizes, and 0.95 and 0.99 probabilities.

Since this method of Q-C is so simple, it will be practical in many instances to have the operator gage each piece. However, if it has been established that the change in process average is slow, the technique may be conducted on a sampling basis. Once every half hour, or other specified time interval, the operator fills his board with a succession of pieces and gets a visual indication as to whether the process should continue running or be reset. end

GAGES: FROM USE TO ABUSE

There is no question that there are appreciable savings to be made in scraped parts and lost production time through better control and maintenance of gages and inspection equipment.

One manufacturer of precision inspection equipment, E. E. Ellstrom, president and general manager, Dearborn Gage Co., speaks from considerable experience in citing cases where gages and other inspection equipment were found to be in regular use long after they had been rendered inaccurate through wear, neglect or abuse.

"For example," he said, "in checking all types of inspection equipment sent in to our plant for repair, much of it has been found to be worn far beyond the limits of accurate operation — indicating that it had been used for some time with obviously inaccurate results."

This situation can be solved in a relatively simple manner by working out proper gaging policies for each job. In working out such policies, he lists the following suggestions for prime consideration:

1. Maintain constant vigilance over procedures and schedules for the checking and maintenance of all inspection equipment.

2. Build a "margin of safety" into all equipment by allowing for finer accuracy and closer tolerances than the production part requires.

3. Keep the inspection operation as close to the machine as possible. Have production gages check the part at all stations — as frequently and automatically as possible within the bounds of practical application.

4. Have necessary master gages nearby for periodic spot check of production parts to make certain that production gages are functioning properly.

5. Have proper storage facilities right at the machine for all inspection equipment involved in the operation.

6. Make certain all personnel involved are adequately trained and skilled in the proper use of inspection equipment.

"The costs involved in establishing and maintaining good gaging policies are far less than the time and material costs which inevitably result from inadequate gage control. Quality cannot be "checked" into a product; it must be built in."

Factors affecting successful in-process gaging include positioning, timing, temperature rises, gage capability and dependability. These all should be established before a transfer machine design is finalized. Further, many of these probe gaging ideas can be used in far simpler production setups than long transfer lines.

PROVIDING IN-PROCESS Q-C FOR TRANSFER LINES

by George Whitehouse
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CONSISTENT PRODUCTION of accurate parts on modern transfer-type special machine tools is assured by judicious use of quality control devices in the form of in-process gages. Some of these gages may take the form of electrical switches that "OK" properly clamped parts and prevent improperly clamped parts from being transferred into the machining stations. Others may be probing devices that check for through-drilling of tap drill holes, or for broken taps. Still other in-process gages may check for excessive press fits, overload on milling spindles, or bore size accuracy with air gages. It is not unusual for gaging checks such as air tests for leakage or flow to be made while parts are being processed through transfer machines.

The basic purpose of in-process gaging quality control equipment is to prevent high production machines from making quantities of inaccurate or scrap parts. They also act to prevent machine damage resulting from excessive spindle torque loads or broken tools. To adequately serve these purposes, an in-process gage must perform three functions: (1) gage a particular dimension or operation, (2) prevent production of parts after an out-of-tolerance or functional error is detected, and (3) indicate where the trouble area is so that tools can be quickly changed or proper maintenance provided so that the machine can be quickly put back into production.

How Much In-Process Gaging?

The gage mounting means, actuating devices, switches and electrical connections to indicator lights on control panels all add up to make in-process gages expensive features on transfer machines. As a result, a considerable amount of judgement should be exercised in specify-

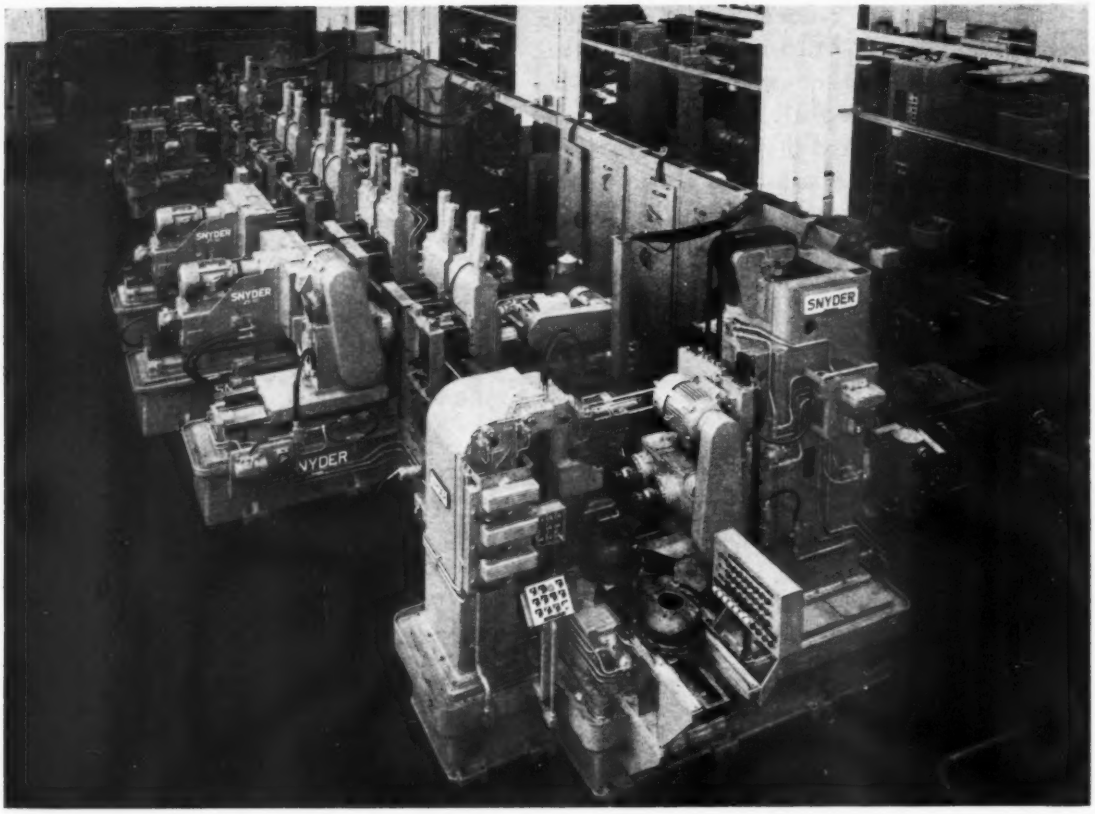


Fig. 1. This segmented 24-station transfer machine includes a precision boring operation, indicative of the trend to including finish machining in a transfer machine's sequence. This 55-ft long machine processes 128 automotive torque converter housings per hour. It is shown here on the manufacturer's final assembly floor.

ing the amount of in-process gaging equipment. Otherwise, the economic justification for the machine may be affected.

Special machine tools of the transfer type usually perform milling, drilling, reaming, tapping and allied production operations with the parts held stationary in the machining stations. If a part is difficult to clamp and could possibly be positioned and clamped in pallet-type fixtures so that machine components or tools could be damaged, it is wise to consider some sort of quality control devices that will prevent clamping errors.

Milling operations present the problem of overload resulting from excessive stock removal or hard stock. If it is suspected that a specific milled surface on a cast or forged part is subject to stock variations, or that some hard spots may be encountered from time to time, the inclusion of torque meters on milling spindle drives may be a wise initial investment in a transfer machine.

Experience has shown that the drilling and tapping operations on transfer machines are the critical areas where in-process gages of the probe type serve a most useful purpose.

A tap drill that breaks before completing its feed means an incomplete hole and a subsequent broken tap. Further, broken taps left in parts can also provide a problem when the part gets to the assembly line. Thus, probe type quality control devices that check for through-drilling or broken taps are well worth the initial cost and should be seriously considered to assure consistent high production.

There are special cases when assembly operations are performed on transfer machines where specialized in-process gaging devices may be necessary. If parts are being press-fitted to a load specification, the amount of press fit may be a gaging requirement where both excessive and insufficient fit conditions should be gaged. This can be accomplished by providing suitable pressure measuring devices and controls in the hydraulic circuit for the pressing ram. Proper orientation of parts before they reach the assembly area on a transfer machine may also be a gaging requirement.

There is an increasing trend toward performing precision metalworking operations on

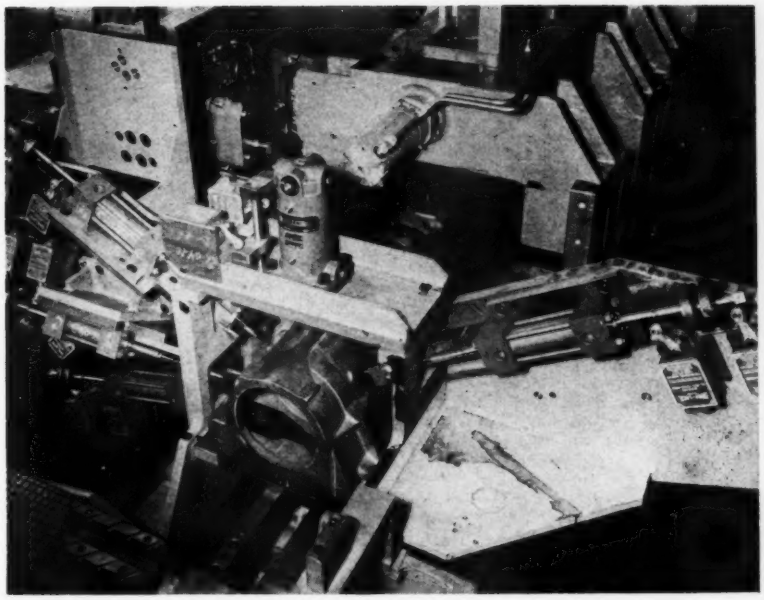


Fig. 2. Direct-acting tap drill probing devices for checking individual holes in several radial locations, but in one plane, on an automotive transmission case transfer machine.

transfer machines, Figure 1. When this is done, it means that precision gaging must be provided to check size tolerances of holes that will have no subsequent finishing operations after they leave the transfer machine. Air gages can be effectively utilized to provide the necessary gaging and quality control functions providing special attention is paid to the rigidity and ruggedness of the air gaging station.

Probe-Type Gaging Devices

A probe-type gaging unit has a probe smaller in diameter than the hole it checks for depth. The probe is moved by a hydraulic cylinder. If the probe encounters the bottom of an incomplete hole, it fails to trip a switch and the machine is prevented from cycling the part to the next station. Failure of the probe to traverse through the hole also causes a light on the master control panel to glow, thus indicating to the operator the exact station where a broken drill can be replaced.

Where single holes or holes in a variety of plane locations have to be probed, a direct-acting type of probing device is utilized, Figures 2, 3 and 4. The individual probes are controlled by small hydraulic cylinders that operate on about 65 psi hydraulic pressure. The cylinder is prevented from making a full stroke when an incomplete hole is encountered. Di-

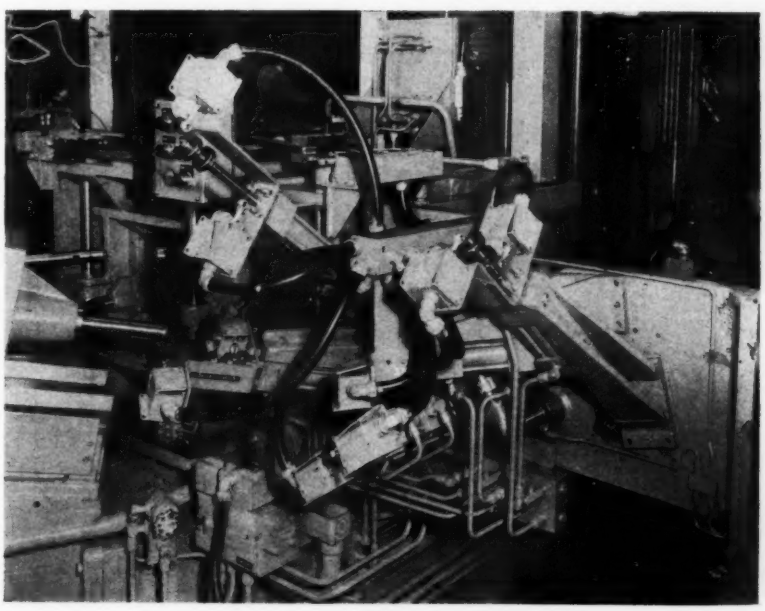


Fig. 3. The hole probes in this transfer machine station are positioned for checking holes in several planes. Such cases, calling for the probes "coming in" from several directions, mean that proper orientation of the workpiece in the station is of paramount importance.

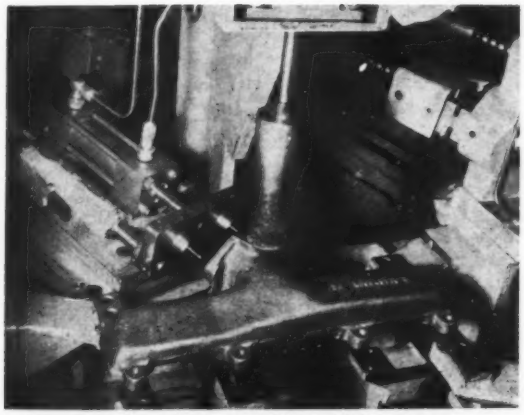


Fig. 4. In a transfer machine which processes exhaust manifolds, the two hole probes at this station project from a plate actuated by a single cylinder.

rect-acting probe units are usually mounted on individual brackets.

When more than one hole is drilled in a surface, another type of probe gaging design, called a spring-loaded plate, is applied. In the spring-loaded design, several probes are mounted on a plate. If one probe on the plate locates an incomplete hole, a signal light discloses the station involved, the plate is prevented from travelling a full stroke, and the hydraulic cylinder completes its stroke. The switch actuating components are mounted on the plate proper. A plate-type probing device can be easily mounted on the side of a drilling head in a position to follow the drilling operation and thus will need no separate actuating cylinder.

Aside from the direct-acting and plate type probes which have broad applications on transfer machines, there are other types which can be used in certain applications. One of these is one in which the drill itself acts as the probe. A carbide-faced actuating switch beneath the hole is contacted when the drill has travelled through. If the switch is not contacted, the machine will not cycle and an indicator light is turned on. Applications where the actuating switch lies in machine areas full of coolant and chips should be avoided with this type of probing concept.

Electric probes in which the probes are wires that contact grounded drill spindles can also be used as gages to check for broken drills. One type uses a single hydraulic cylinder to move a series of probe wires past the drills after they have completed the drilling operation. Failure of any probe wire to touch a drill indicates that the drill is broken. The machine will not cycle and a signal light operates.

Another electric probing device utilizes a mechanical cam and plunger to pass wire probes past the drills as soon as the drillhead retracts.

Gaging for Excess Stock

There are two methods of checking for excess milling stock; one is to make use of torque meters as mentioned previously, and the other is to use switches whose contacts are operated by engaging the rough surfaces before the milling operation is carried out. It is a simple

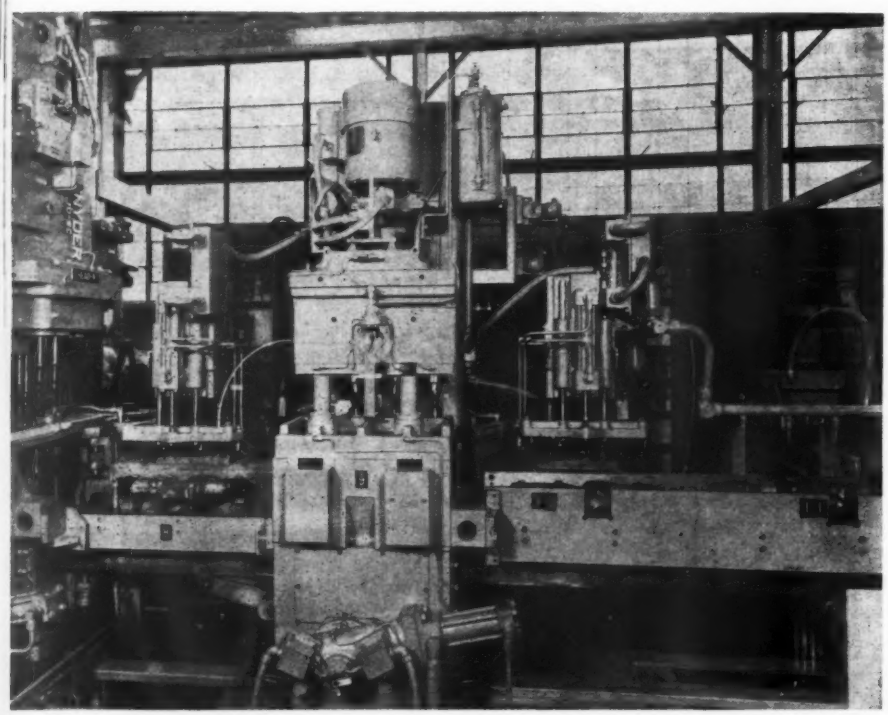


Fig. 5. The transfer sequence shown here is a typical probing setup for tap drill and broken tap in-process gaging on an exhaust manifold. The drilling station is at the extreme left; next (8), direct acting probes cover the hole pattern; (9), the tapping station; followed by (10), probes for warning of any broken taps. Note that both probe plates carry spring loaded locators that hold the part during the probe travel.

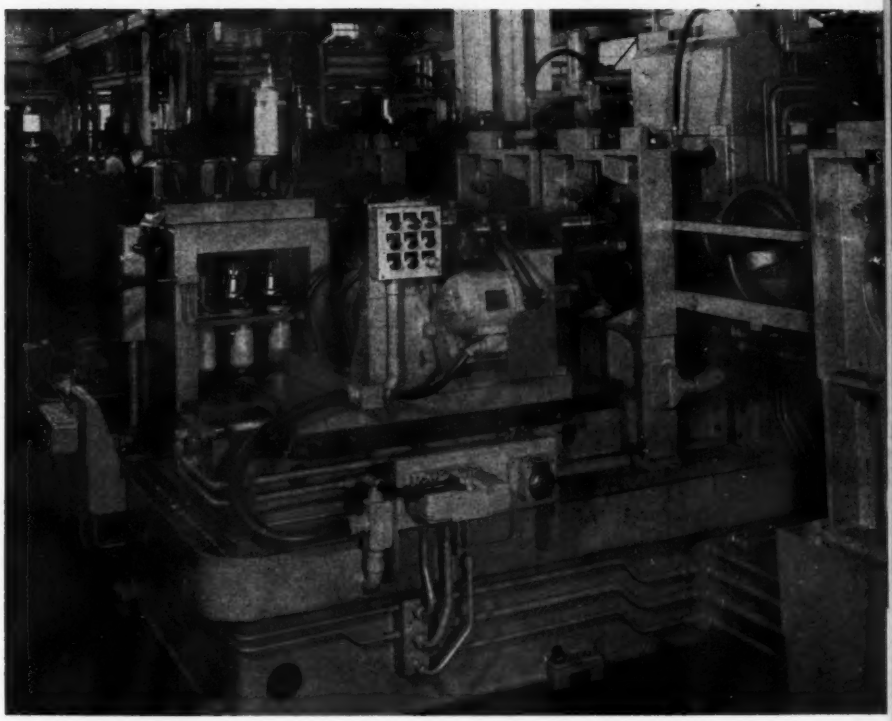


Fig. 6. A transfer machine boring station followed by the air gaging station shown at the left. At the boring station a 5⅞" dia bore and two dowel pin holes are precision bored along with one hole reaming. All four holes are air-gaged with a slide unit of design similar to the machining unit.

matter to position the switches in such a manner that they will prevent machine index and indicate trouble source on the control panel when excess stock is present.

Such arrangements cannot, however, detect hard spots. For this reason, particularly where expensive milling cutters and high milling thrust loads are encountered, torque meters can often be the most effective and cost-saving solution. When a torque meter on a milling head drive motor indicates an overload condition, the milling unit is immediately thrown into return travel. The head will not advance to milling position again since it did not travel its initial full distance, and the machine shutdown function is adequately provided for.

Where to Locate Gages

A basic rule to follow in installing in-process gages on transfer machines, where machining heat generation is not a factor, is to place the gages where they will check the tolerance or function as quickly as possible after it has been machined. This prevents a succession of parts in process on the machine from being out of tolerance.

Present tap-drill probing practice is to gage for through-drilling immediately after the drilling station. Broken tap checks are made after the tapping operation. The probe check can be made both before and after the tapping station, Figure 5, thus providing for both through-drilling and broken tap inspection.

The tendency of parts to heat up during milling operations on transfer machines has a definite effect on gage location. When parts such as automotive intake manifolds are air tested for leakage or flow, good gaging practice dictates that these tests be made several stations beyond the milling operations to allow the parts to cool off. Otherwise, the accuracy of the test will be considerably impaired. The same considerations hold true with air gaging operations, the accuracy of which is severely affected by part temperature.

Applying Air Gages

The use of air gages on transfer machines to check bore size accuracy is a very recent development which has come about as a result of the trend toward including precision finish machining operations in the transfer line. Successful use of air gages depends directly upon the rigidity of mounting and freedom from vibration. It has been found that the gaging station must be at least as rugged in design as the machining station, Figure 6, whose output it is checking. As transfer machines continue their design trend toward providing all rough and finish machining operations as well as assembly operations in a fully automated line concept, it can be expected that more and more precision in-process gaging devices will be required to provide adequate control of part quality and to prevent excess scrap production.

end

PLUNGE ROLLING HOSE ADAPTORS ON A MULTI-SPINDLE AUTOMATIC

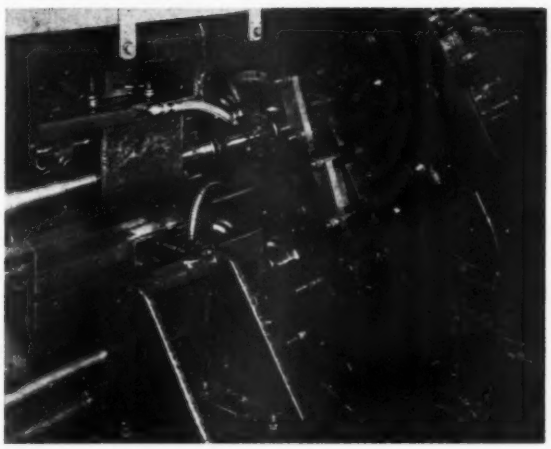
WHEREVER APPLICABLE, SINGLE THREAD ROLLS are used on automatic bar machine jobs, particularly since some of the leading manufacturers of thread rolls and thread-roll holders have standardized rolls for single-roll applications. Obviously, on this work, total pressure developed by the thread roll during operation cannot exceed a reasonable limit, beyond which excessive deflection of the work or excessive wear on the machine would result. Because of this, material being threaded must be considered when reviewing any specific application.

Plunge rolling can be performed on soft material such as aluminum and brass or on jobs where thread length is short, with a greater degree of impunity than where thread length is great or material is relatively hard. Although the holder body on some single-roll holders is made to swivel on the base plate, correction can be made for a modicum of deflection on the work, one cannot go too far in this direction. The same swiveling provision on the holder body allows one to correct for any taper in a thread which may be caused by improper positioning of the holder.

Most single thread rolls employed on screw machine work are not equipped with bushings or needle bearings. In cases where machine spindle speed is quite high, however, a definite advantage is obtained by using a roll with a bronze bushing or needle bearing. Some manufacturers of such rolls recommend use of bronze bushings or needle bearings in any case where roll speed is approximately 800-1,000 rpm. Roll speed is computed by dividing machine spindle speed by the number of starts on the roll employed.

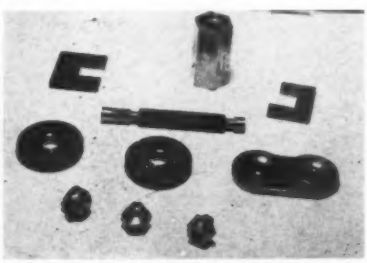
One interesting job where a plunge roll is incorporated in the tooling is production of special nipples at the Alemite and Stewart-Warner Instrument plant or Stewart-Warner Corporation in Chicago. The workpiece is designed to function as an adaptor in Alemite hose assemblies made by this firm.

Rear view of the tooling area of bar machine working on the hose adaptor nipple. The standard threading attachment is clearly seen in the fourth position, and the plunge roll layout on the cross slide in the fifth position.



Three finished workpieces are in the foreground, and different gages used on the job are behind them.

Photographs courtesy Greenlee Bros. & Co., Rockford, Ill.



Front view of tooling area of a Greenlee 6-spindle automatic working on special adaptor nipples, at the Alemite and Stewart-Warner Instrument plant.

The job is set up on a Greenlee 6-spindle unit, and is machined from 13/16 hex steel, B-1113, which answers to Stewart-Warner specification 192-02 SR. Cycle time on this job is 13½ sec; cutting time, 11½ sec. Spindle speed is 987 rpm which provides a work surface speed of 242 sfpm. A sulphur base oil is coolant.

Ratio of the cross slide in the first position is 3-1, rough forming with a ½ in sq tool bit. Centering is performed in this first position with the tool slide, which also carries a knee tool. In the second position, the tool slide advances a 7/16" drill for a throw of 9/16". At the same time, a circular form tool is used on the cross slide, with a ratio of 3-1. At the third position, a Slitters dovetail shave tool is carried on the cross slide, with a ratio of 2½-1 and a feed of 0.0012". Concurrently, reaming is performed on the previously drilled hole from the tool slide.

The cross slide is inactive in the fourth position, but a standard Greenlee threading attachment, fitted with a yoke suitable for carrying an 1 1/16" capacity die head, is used to cut the 1 1/16-27 thread on the forward end of the nipple. The plunge roller attachment referred to, carried by the cross slide in the fifth position, is operated from a special-ratio cam. Concurrent with action of the single threading roll, a 3/16" drill is advanced by the tool slide, drilling the rest of the way through the workpiece.

Action in the sixth position is limited to cutting off the part, using a 2½-1 ratio cam. Cycle time referred to on this job provided a gross rate of 266 pcs/hr. end

Fig. 1. First step in quality control is to check core length on armature shaft to a tolerance of .015" with a scale. Armature shaft is also checked visually for scratches.

100% Inspection of 12000 Small Motors Daily

by Raymond J. Kramer
Quality Control Manager
THE LEECE-NEVILLE CO.
Cleveland, Ohio

PRODUCERS OF high volume, small parts face a particularly acute problem in quality control. Not only is the job of testing thousands of parts each day time consuming and expensive, but the product is widely distributed and used, leaving the manufacturer open to criticism from many points if his product is not up to standard.

The Leece-Neville Co., manufacturers of small electric motors, alternators and other electrical system components, has come up with an eight-point quality control program on its small motors production line which 100% tests every motor assembled. Currently, we are turning out around 12,000 of these small motors per day.

Quality control on small motors involves two major problems: performance and noise.

Performance, of course, is primarily a function of design, but accurate quality control sees to it that design specifications can be maintained during use. In a small motor, this means that at the specified operating voltage, the unit will deliver the engineered torque and speed.

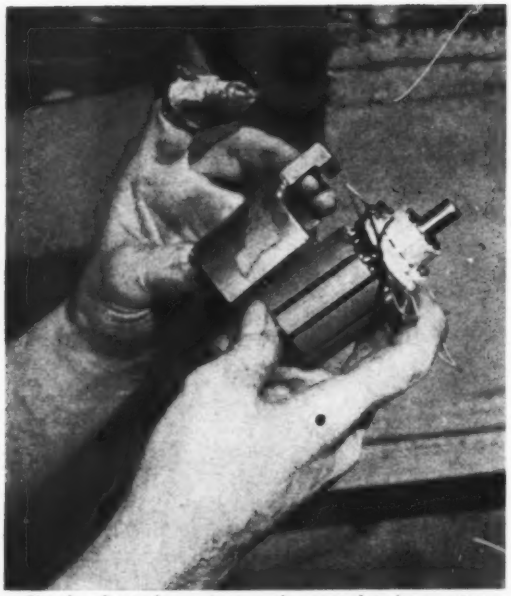


Fig. 2. Second step is to make sure slots in armature core correspond with slots in commutator. A tool steel gage with a welded head is used.

Noise levels are more a matter of end use than scientific levels of measurement. The level of sound produced by the operating motor in a final installation can depend, in great measure, on where it is installed. If a motor is installed by the buyer inside a loosely attached housing, for example, normal vibration may set up a noise level which bears no relation to workmanship on the motor itself.

To get around this problem, in addition to its sub-assembly quality control program, Leece-Neville technicians test each motor on the type of work it will perform before it is shipped to the buyer.

First step in the quality control program is at the first assembly point on the armature sub-assembly line. Here, after the laminated cores have been stacked on the armature shaft, the shaft itself is checked visually for scratches,

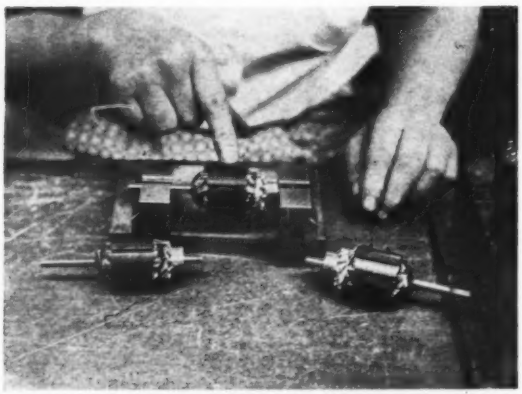


Fig. 3. Armature shaft is then checked for straightness on gage made with precision end mounts. If shaft spins freely there are no bends.

and core length (the length of the core on the shaft) is checked with a scale, Figure 1, to a tolerance of .015". A scratch or a burr on the shaft can be one of the principal causes of a noisy motor.

The next check is made following positioning of the commutator on the armature shaft, after insulation, end laminations and windings have been assembled. This check is made with a tool steel gage in the shape of a semi-cylinder, which fits tightly around the armature core, Figure 2. A pin projection is welded to the top of the gage, and this pin fits into a groove in the commutator. The slots in the armature core and the commutator must correspond exactly or the motor will not function properly.

Fig. 4. Circuit check is made for shorts, opens and grounds with a simple electrical test setup. Buzzer sounds to indicate complete circuit. Ground detector is at right.

After the leads from the windings on the armature are connected to the commutator, the armature shaft is checked for straightness. The gage for this job is comprised of a base and two end blocks or tool steel mounts. The end mounts of the gage are channeled to a tolerance of only three "tenths" larger than the armature shaft itself. The armature is laid in the channels and spun manually by the tester, Figure 3. If the shaft is bent or out of line, it will not move.

When the commutator has been turned to insure a smooth finish, a check is made for grounds, shorts and open circuits in the armature windings, Figure 4. This completes the quality control operation on the armature sub-assembly line.

In the field coil sub-assembly line, a continuity check is made after the coils have been

wound and pressed to initial shape. This test is made with a simple low voltage electrical system on the assembly line. Two lead slugs, approximately one inch round, are mounted on the bench, Figure 5. They serve as the contact points of the circuit. When the opposing ends of the windings are touched to the contacts, a battery-operated buzzer notifies the operator that the circuit is perfect. If no sound is heard, the tester knows that the circuit is open. In conjunction with the system, a red light signal indicates automatically if there is a ground in the system.

Quality control is a major factor in the final assembly of the motor. After the field coil has been inserted in the stator, clamped and fixed in position, and the leads soldered to their terminals, another continuity check is run on the entire circuitry of field coils and leads, Figure 6, in exactly the same manner as the earlier circuit checks. Again lead test terminals are used, laying the sub-assembly against a steel plate as a ground, with a buzzer and red light system indicating whether or not the system is in working order.

Fig. 5. Circuit check on field coil sub-assembly.

The brush rigging card (which contains the terminal leads) is then riveted to the commutator end housing, the stator is inserted, and the armature is checked once again for length over the washers (which control end play in the shaft) to end play limits of .005″ to .015″. This check, Figure 7, is made with an armature gaging fixture. The armature is then inserted, the drive end housing screwed into position and the motor is ready for final testing.

Before final test, each motor produced is run for 15 minutes on the run-in rack, Figure 8. This initial run frees up the motor, wears in the brushes and serves to make final test results more consistent.

From the run-in rack, the motors move by conveyor into the final check booths, Figure 9.

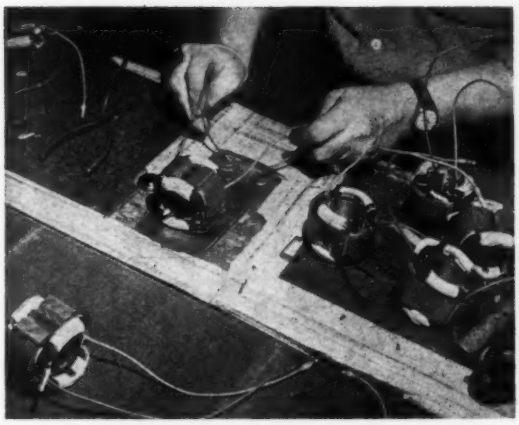


Fig. 6. Same test as in Figure 5, but on completed field coil sub-assembly.

Here the units are checked for performance and noise in an actual simulation of end use. The check booths are sound-proofed so the operator can closely check noise levels. Motors to be used on fans are checked to see that they will pull in or exhaust the proper amount of air. Motors intended to pull or push a load are checked on a Chatillon dynamometer for torque at the specified voltage level. Speed is measured by a stroboscopic light unit.

Leece-Neville also has constructed a check booth which automatically indicates whether the motor can live up to its power requirements. The motor is mounted in a fixture which allows the armature to turn freely. A dynamometer and an electronic amplifying system with light indicators is attached to the system, Figure 10. As the motor passes through the operational speed zone, a light on the amplifier indicates whether the proper torque is being developed. The test can be run from starting to standstill point, with the dynamometer showing the final torque reading. This

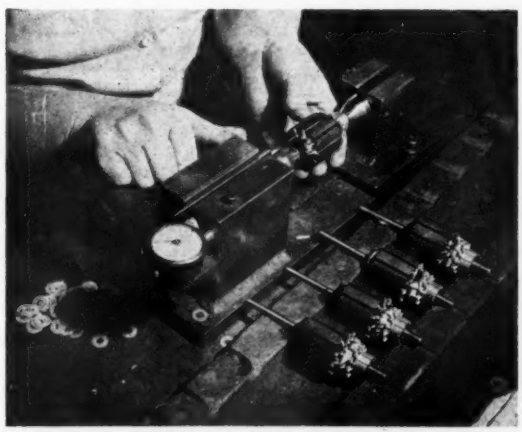


Fig. 7. Final checking of armature core length over washers for end play limits of from .005″ to .015″, on an armature gaging fixture.

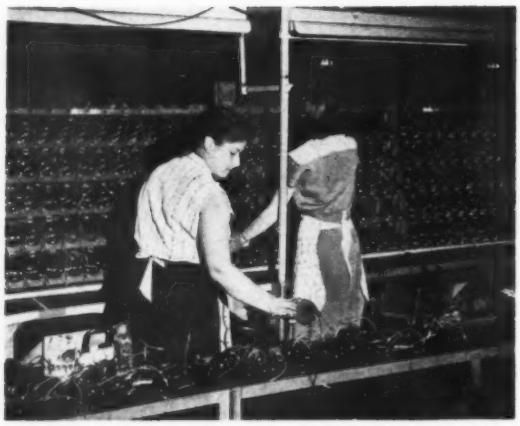


Fig. 8. Run-in rack, where motors are run for 15 minutes to free them up, prior to final test. Motors move on conveyor belt to final check booths.

Fig. 9. In darkened, sound-proof check-booth, operator determines speed (on stroboscopic light unit), voltage, amperage and noise level.

Fig. 10. Dynamometer check measures torque available from motor at predetermined operating speeds.

novel arrangement saves the operator the trouble of checking individual torques at individual speeds, providing instead a range of torque efficiency. The system can be reversed to run the motor in either direction.

When the motors emerge from the final test booths, they are given a final visual and manual inspection for end play, identification plate and lead lengths.

After this check, the units, in 6, 12, 24 and 32-volt DC, and 110-volt AC models, are packaged for shipment.

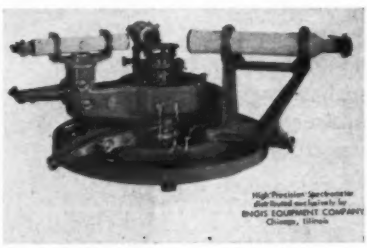
end

SPECTROMETER TESTS ANGLES AND CIRCULAR SPACING TO .1 SEC

The Guild-Watts spectrometer is a universal tool for testing angles of prism faces, gage block combinations, instrument assemblies, etc.

One accurately divided circle is used to read both table and telescope positions. Either the workpiece mounted on the table or the telescope can be rotated independently of each other, and with or without the circle. The circle reading corrects centering errors and is direct to .1 sec.

Two telescopes are provided. One is mounted on the main bearing and properly counterbalanced; the other is mounted independently on a pillar which fits into a ring on the base of



the instrument. This permits any suitable position to be selected. Both telescopes are provided with micrometers at the eyepiece ends, which can be rotated through 90° from the horizontal for vertical measurement.

A collimator, also carried on a pillar, can be set to any desired position around the ring on the base. Its objective is larger in diameter and of longer focus than the telescope objectives. An auto-collimating eyepiece for the telescope is available, which permits it to be used as a precision auto-collimator.

The unique precision instrument should be of special value as a universal testing device for guidance systems, automation devices, and other precision components and assemblies, according to Engis Equipment Co., 431 S. Dearborn St., Chicago 5, from whom details are available, or — **Inform-A-Gram No. D-2.**

AUTOMATED CONTROL OF GEAR QUALITY

by Ben F. Bregi
Vice President
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A basic mechanical precept is, "where there is noise there is wear." Hence, quiet gears are good gears. When you consider, for instance, the number of meshed gears in your car's automatic transmission you can appreciate the problems tossed at the gear manufacturers. The answers are found by quality control in gear production.

THE INCREASING USE OF AUTOMATION in producing gears in large quantities has led to the recent development of a variety of new processing and inspection methods to assure that gears of maximum accuracy and minimum sound level are consistently produced. Among these new methods are automatic gaging and sorting for dimensional accuracy, automatic sound testing for uniformity of noise level, and automated gear honing for removing nicks and improving sound quality. All of these are, in reality, in-process gaging and processing methods that effectively control the quality of every produced part. The gages shut down gear-producing machine tools as soon as they start to produce inaccurate parts, as well as acting in a reject and sorting capacity.

Until the advent of the automatic transmissions for automobiles following World War II, gear quality had been largely controlled by utilizing rotary gear shavers to produce uniform gear teeth prior to heat treatment. The shaving process was the quality control measure that made all gears identical as far as size, tooth form and lead were concerned. Modifications in tooth form and size for heat treatment changes were provided by the shaving operation.

Because the shaving cutter removed small amounts of stock, it had extremely long life and only spot gaging checks were made on various batches of gears being produced. In the hardened state, the gears were sound tested with a master to locate those with nicks as well as those of poor sound quality.

In the transition from individual machine production concepts to the fully automated line, automatic loaders were applied to gear

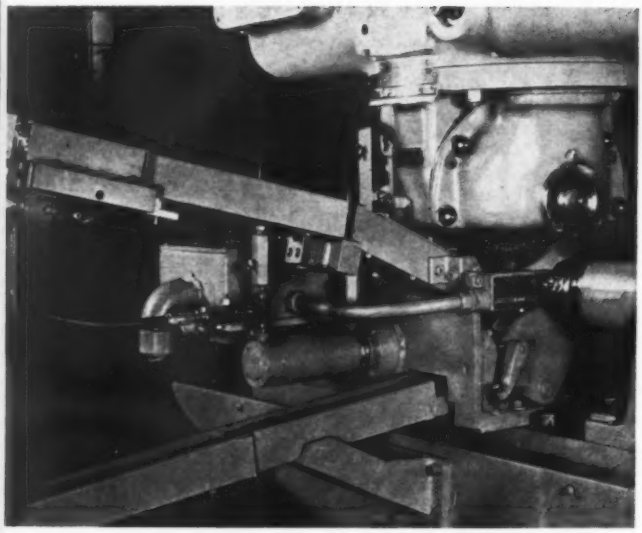

Fig. 1. Closeup view of a shaving machine equipped with an automatic loader and installed in an automated line.

shaving machines. These loaders had a marked effect on improving gear quality. They avoided the nicking of gears that occurred with manual loading operations. They also eliminated shaving cutter damage due to careless manual loading. These automatic loaders also had some built-in gaging devices. Before the gears were placed in the loading magazine, they were passed between a pair of gears. Oversized gears from the previous gear generating operation thus could not be fed to the shaving machine.

The automatic transmission had two effects on gear production concepts. First, it created demands for much more total gear production, since automatic transmissions have many more gears than synchro-mesh transmissions. And second, it made the production of more accurate and quiet gears a necessity, since more gears were in mesh and increased sound levels could not be tolerated.

The combination of needs for increased production coupled with better quality made the requirement for automation techniques almost immediate. And with these came the continuous feed automation concepts, intermachine part storage equipment, and the development of special equipment and processes that would assure the consistent production of high quality gears.

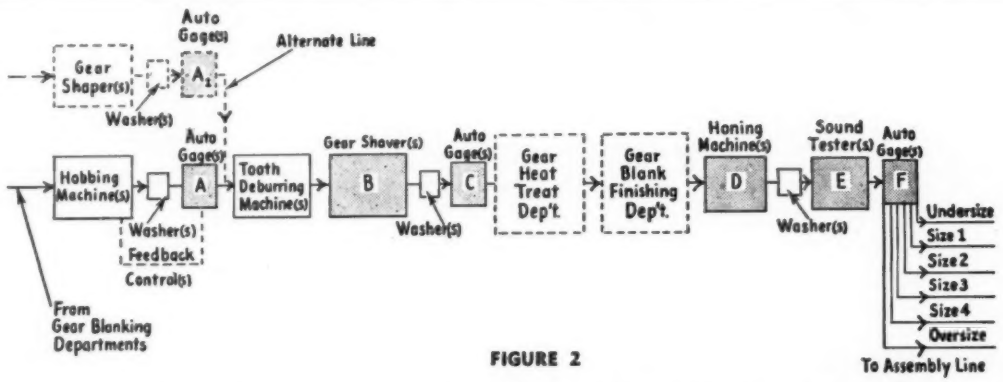

FIGURE 2

QUALITY CONTROL EQUIPMENT FOR A MODERN AUTOMATED GEAR PRODUCTION LINE

Key	Quality Control Unit	Function
A	Automatic Gear Checker	Checks size and helix angle, can provide hob shifting feedback control. Shuts down hobbing machine if out-of-tolerance parts are produced.
A_1	Automatic Gear Checker	Checks size. Can check for full-tooth. Shuts down shaper if out-of-tolerance parts are produced.
B	Rotary Gear Shaver	Removes small amount of stock from tooth profiles to produce uniform involute form, lead, and tooth size. Equipped with automatic loader.
C	Automatic Gear Checker	Checks size only. Shuts down shaver if out-of-tolerance parts are produced.
D	Gear Tooth Honing Machine	Removes nicks and burrs, improves surface finish and gear sound quality. Equipped with automatic loader.
E	Electronic Sound Discriminator Gear Speeder	Checks gear for sound quality. Rejects gears not meeting sound standards. Equipped with automatic loader.
F	Automatic Gear Checker	Sorts gears into size ranges for assembly.

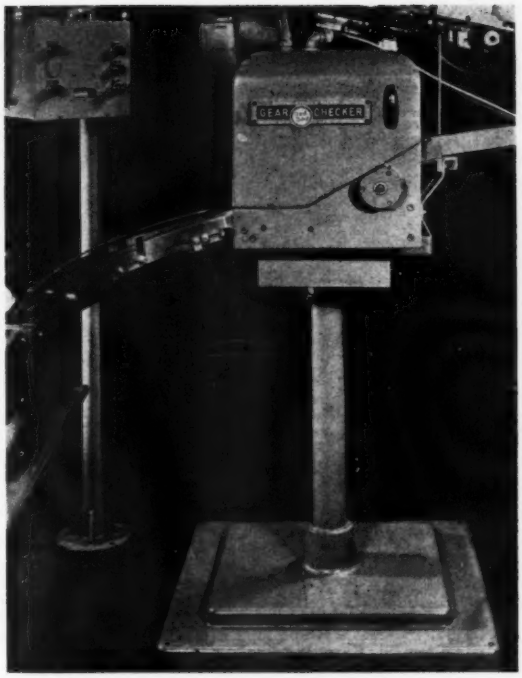

Fig. 3. An automatic motorized gear checker that inspects gears for size and helix angle accuracy. This type of gage is ideally adapted for quality control of gear generating operations.

These new methods continue to make use of the shaving machine and automatic loaders, Figure 1, as quality control measures but include new equipment, Figure 2, that meets the needs of a production line which is so automatic that it has no value unless quality measures are included.

There is no single gaging concept that can be applied to the automated production of gears. The gages must check the dimensions being produced by the machine tool, shut it down when inaccurate parts are being produced, and may even utilize feedback equipment to change machine settings based on measurement of produced gears. Although the gaging equipment that performs these functions for individual gear-producing operations may look identical, certain specific differences are present.

Gaging Automated Tooth Generating Operations

In a gear production line, one key to consistent production is that the gears clean up on the shaving machine. If too much stock is left for the shaving operation, cutter life is shortened, and the accuracy of the produced gear is lowered. If insufficient stock is left for shaving, then the gears will not clean up and uniform accuracy is not achieved. Thus, the gear must be checked for size in the tooth generating operation.

It should also be checked for helix angle accuracy as this also affects the stock removal by the shaving machine. If the gear is produced by a gear shaper, it may be wise to check the gear for complete teeth to make certain that the shaper cutter has completed its circuit around the gear.

In the case of a hobbing machine being used for generating the teeth, it is conceivable that a feedback device should be built into the gaging equipment so that the hob can be automatically shifted to a new position when part accuracy tends to lower. The decision to use feedback devices is directly dependent on the practicality of adjusting the machine. On a

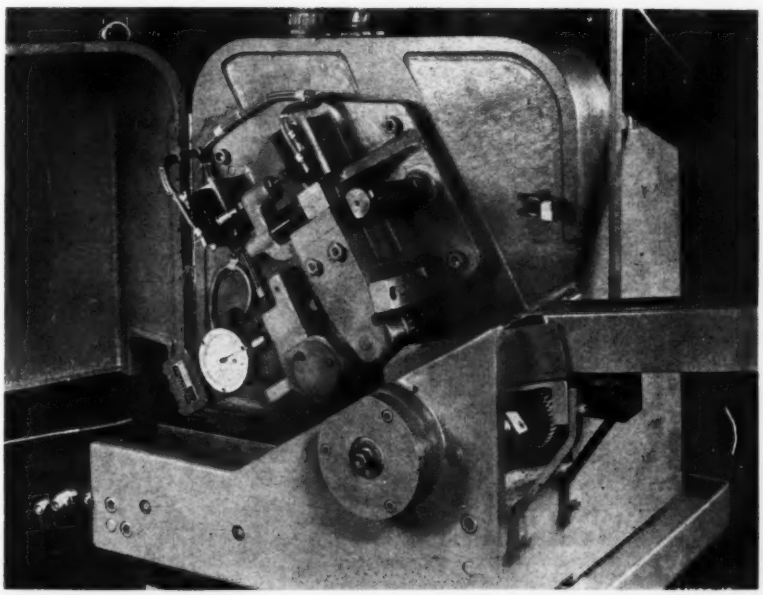

Fig. 4. Closeup of an automatic motorized gear checker that inspects gears for size. This type of gage can be used for quality control of gear shaving operations. It can also be adapted to the sorting of gears into specified size classifications.

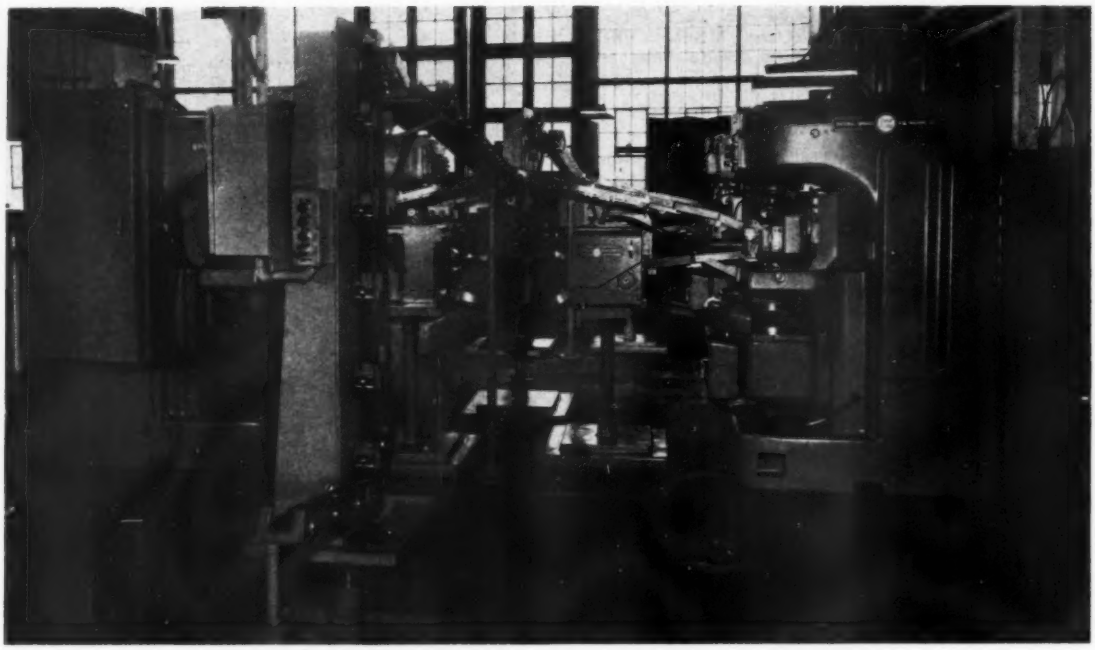

Fig. 5. The gear shaving section of an automated gear production line. Motorized gages are provided to inspect the output from each shaving machine.

gear shaper for example, it might not be wise to include feedback control of cutter-to-work center distance, as the cutter will usually produce gears to size until it is dull. A check of helix angle on a shaper-cut gear might also be unnecessary since this feature is accurately controlled by helical guides.

A typical gage that continuously checks both size and helix angle of hob-cut gears is shown in Figure 3. This motorized gage can be equipped with feedback controls to adjust hob positioning based on gaged size measurements, or it can shut the machine down after a predetermined number of reject parts have been produced.

Gaging Automated Gear Shaving Operations

If all output from the gear tooth generating machine is automatically gaged, there is no necessity for gaging the gears before they are fed by the automation system into the loader on the gear shaving machine.

Output from gear shaving machines can be gaged on motorized gages, Figure 4, similar to the one shown in Figure 3. As previously stated, gear shaving cutters will finish many thousands of gears before they have to be removed and resharpened. Thus, the inclusion of feedback features that would adjust cutter-to-work center distance seems to be unnecessary.

Adequate control of quality is effectively achieved by gaging the shaved gears for size only and shutting down the shaver only after a predetermined number of rejects have been produced. A motorized gage for each shaving machine, Figure 5, thus provides the required quality control measures. It should be noted that involute profile accuracy is not checked on motorized gages. Although this could conceivably be accomplished, proper inspection of gear tooth generating tools and shaving cutters before they are installed on the machine tools nullify this checking requirement.

It is strongly recommended that gears be passed through compact washers before they enter motorized gages on any gear production quality control operation. Minute metal chips, shavings or cutting oil can have extremely detrimental effects on gage measurements and often render the gages useless as far as production utility is concerned.

Removing Nicks and Burrs and Noise

A problem that has always plagued the gear production department is the removal of nicks and burrs. The nicks are still in evidence — even in the automated lines — because gears unavoidably do touch each other. The specification of chamfers on the tips of the generated tooth forms have done much to remove burr problems. But there are still burrs at the edge faces of gear teeth which have to be removed by special burring equipment. In spite of these precautions, nicks and burrs do show up in hardened gears and there has previously

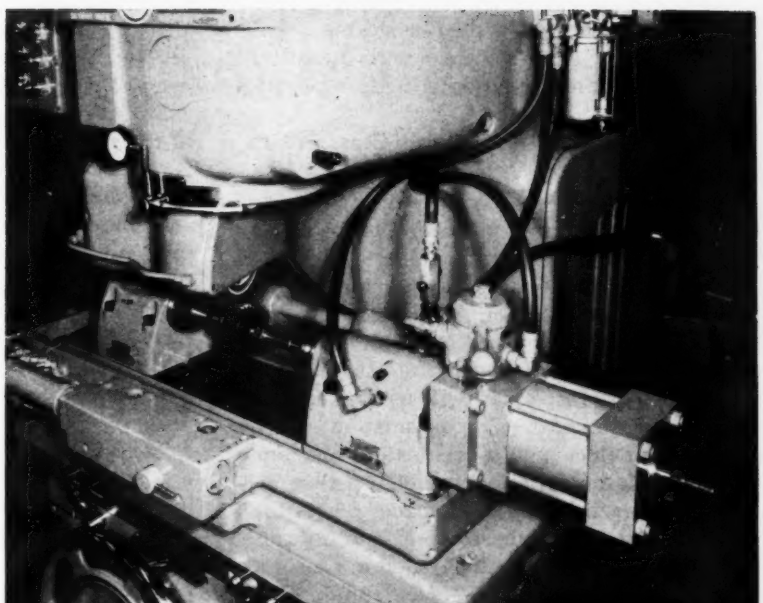

Fig. 6. Closeup of a gear tooth honing machine with automatic loader removed to show the hinged table arrangement that provides zero backlash honing.

been only one way to remove them. That was with a pencil grinder after they had been detected in the hard gear sound tester.

There is now available a new hard gear finishing method of removing these nicks and burrs which at the same time improves the surface finish and general sound level characteristics of the gears. This new Red Ring gear honing process provides built-in quality control measures that are effectively achieved by passing all hardened gears through the honing machine to the sound testing operation. All manual nick removal operations are avoided by this processing method and the overall sound quality of the gears is improved.

The gear tooth honing process makes use of an abrasive-impregnated plastic honing tool made in the form of a helical gear. Hardened gears are run in mesh with this tool at extremely high speeds while being reciprocated back and forth along the gear axis. A unique zero backlash device in the honing machine, Figure 6, permits the operation to be carried out under no-backlash conditions.

Automation of the gear honing operation is achieved with automatic loading devices, Fig-

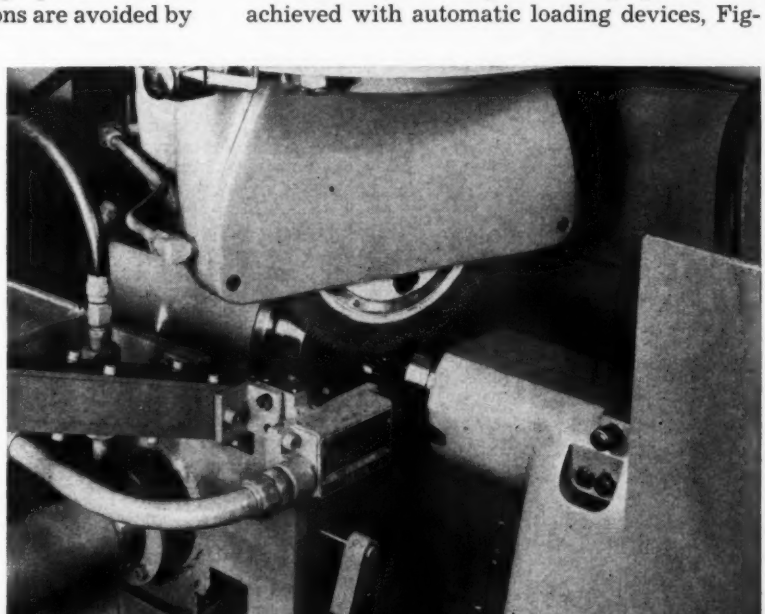

Fig. 7. The automatic loader applied to a gear tooth honing machine. A finish-honed pinion may be seen in the exit chute. The finish-honed pinions, nick-free and burr-free, go to an "electronic ear" for a sound — or quiet — test.

ure 7, which include a feed magazine. The loaders feed the gear into mesh with the cutter and unload it after an automatic honing cycle.

Automated Testing of Hardened Gears For Sound

After the hardened gears have been honed to remove nicks and burrs and improve the sound quality, they can be transferred to fully automated "electronic ear" sound testing machines, Figure 8, that will automatically inspect each gear for sound level. This sound discriminating test equipment can be calibrated so that the gears that pass inspection will meet a certain sound level standard. The automation equipment on the electronic sound testing machine includes an automatic loading device that includes a magazine feed. The loader places the gears in mesh with a master gear and unloads them after they have been speeded in an automatic cycle, in which the gears are run in mesh in both directions.

The microphone pickup located near the gear meshing area is the quality control device built into the sound testing equipment. Any gears that do not meet the sound level requirements are automatically diverted from the exit chute on the loader.

Automated Size Selection

Maximum efficiency and load carrying capacity of gears in planetary gear sets is achieved when each gear operates under the same backlash conditions. Automatic transmissions have one or more planetary gear sets and can make efficient use of production quality controls that will provide gears in separate and distinct size ranges. This sorting of gears for size ranges can best be achieved by performing the operation in a motorized automatic gage at the assembly area after the hardened gears have been honed and sound tested.

Size-sorting gages can be of a type similar to the gage illustrated in Figure 3. Only size is checked and one new model of this type sorts the gears into four size ranges plus oversize and undersize classifications. The size measurement of the gears as they are meshed with the master gear in the motorized gage causes the gears to drop into selected chutes that correspond to a specific size range. Thus, it is quite a simple matter to control gear size sorting operations.

Economics of the System

It is possible to build quality control gages for automated gear production lines to check almost any dimension desired. However, to err in the direction of too much checking is as dangerous as erring in the direction of lack of control measures.

Maximum efficiency and economy is achieved when the quality control measures check only the features being produced by the particular operation. The control of the machine tool by the gage must take into consideration the characteristics of the machine or process so that only adequate — not too much — quality control is provided. Nothing will kill a quality control system quicker than proof that the controls are more than adequate and that the gears can be satisfactorily produced with all or a portion of the controls shut down.

The gear quality controls described in this article have been in operation a sufficient amount of time in several gear-producing plants to prove their value and worth in mass-producing gears of consistent high quality.

end

Fig. 8. An electronic sound discriminator with guards removed to show the microphone pickup behind the meshing master and production gears. The automatic loader with its magazine is at the left.

TRAINING FOR EFFECTIVE QUALITY CONTROL

by W. J. Masser
Manager
Quality Control Engineering Service
GENERAL ELECTRIC COMPANY
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Here, Mr. Masser presents the most advanced concepts of Quality Control. These must be fully appreciated in order to formulate an adequate training program.

IN DEFINING QUALITY CONTROL one hears many variations; therefore, in training for effective quality control, it appears that the first step is to have a clear understanding as to what we expect the Quality Control function to accomplish.

Our own studies at General Electric indicate that the quality control job as we see it is very different in many ways from most industry interpretations. These differences are mainly based on our belief that quality control should play a much more important role in industry than is generally accepted. And, perhaps even more important, that this role will grow still greater as our technology advances.

We see quality control as the means for effecting the orderly progression of a product to meet standards and at the right cost throughout its contact with the entire business organization, starting at the very beginning when the marketing department is surveying for customer needs or when the product may only be an idea of an engineer. Next, as it takes form in drawings and specifications, then as raw materials, followed by the actual manufacturing, and finally as it is boxed and shipped and has satisfied the customer's needs.

By orderly progression we mean that each operation in the cycle not only must perform its function successfully, but also in a manner that will utilize the maximum effectiveness of each succeeding operation. By so doing, non-productive costs in the form of waste, rework, scrap, etc., can be substantially reduced.

The over-all objective and true nature of quality control then takes shape as a business management tool. In the design of the function, every effort must be made to make it a productive, positive part of the business organization and an independent measure of the organization's performance.

Certainly it is responsible for the quality of the product, but more than that is its responsibility for pointing out how quality can be assured before and not after the fact so that optimum quality is obtained at minimum quality costs. With this concept of the new or modern quality control, the training of personnel can now be tailored to satisfy the real needs for quality control specialists and supervisors to administer it.

The quarterback of this modern quality control function is quality control engineering; there must also be an able supporting team of inspection and test. The integrated effort of all three works as a feedback cycle of planning, measuring, and analyzing. In this feedback cycle, quality control engineering operates in two areas: planning for product quality acceptance, and analyzing manufacturing results to seek constantly improved planning. Inspection and Test, operating in the third area, are responsible for quality control activities in the shop, essentially to see that measuring and testing is being conducted according to plan and (very important) to relay current quality data to Quality Control Engineering for analysis.

As the quarterback of the team, quality control engineering is a must to modern quality control. Certain elements of this function might have been performed on a sporadic basis in the past by other types of engineering, but the quality control engineering I refer to is something new under the sun to many businesses. It is not merely a new label for inspection planning nor a fresh designation for test equipment engineering, nor yet a technically planned title for industrial statisticians.

It is, instead, a specialized technical activity with a character of its own resulting from a unique combination of skills in the appropriate phases of production and process technology, as well as in quality control techniques itself. And quality control engineering work is the product of the cross-fertilization of modern developments in several fields; in quality control systems engineering, in the design and use of fast response high precision inspection and testing equipment, in management engineering progress, in statistical methodology, and also an abundant capacity for working well with people. In reality, it has the attributes of a genuinely new sector of the engineering profession.

In experience, education, aptitude, and attitude, the man required for quality control engineering work today is, in fact, not very different from the man entering other long established major technical fields. He must possess, or must have the capacity to acquire, the necessary product and process background. He must possess a technical background which enables him to acquire, if he does not already have it, the growing body of quality control engineering work. He must also have the analytical ability to use this knowledge in solving new and different quality problems.

With this rather impressive list of attributes, let us see why and how they are necessary to the conduct of the quality control engineering function.

Normally speaking, any good business organization tailors its staff, its equipment, distribution system, etc. for the most successful exploitation of its product. Almost without exception, however, certain limitations of these resources also require some compromises in the product. A fine laboratory or development model may be extremely incompatible with

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From the 2nd Annual Quality Control Conference, Cleveland Section, American Society for Quality Control.

the capabilities of the supporting organization, especially its manufacturability.

Too often, this capability, or lack of it, is not so easily recognized and the problems multiply as we attempt to proceed. This is the area where quality control engineering makes its greatest contribution. It is while the product is being created, or redesigned, that the technical proficiency of quality control engineering with its understanding of manufacturing capabilities is brought to bear and exerts its greatest influence. Regardless of the type of manufacturing, mass production or jobshop, industry today is generally much too complicated to expect the responsibility for quality assurance planning to be carried by a function other than one trained specifically for this purpose.

Following quality control, Engineering's influence on the product design is the next very important phase where the quality assurance plan is developed.

A successful quality control program relies primarily on a constant feedback of pertinent information. This means determining what inspection and tests are to be performed, who is to do them, to what degree and, very importantly, how to inspect and test.

New inspection and test equipment may be required. These tools are extremely important to the quality job and this equipment field, where the technology is constantly becoming more complex, certainly is something not to be handled casually.

In today's economy it is also extremely rare when vendors don't play an important role in the materials picture. Therefore, vendor rating and certification are a must to appreciably reduce the cost-increasing irritations that generally accompany the purchase of materials. I might also add that too often vendors are more than happy to cooperate to help us in our plans, yet many times problems that develop can be traced back to poor or incorrect instructions from the purchaser. This only points up the need for better training and skill required in this area.

Before all the machinery has been set in motion, in-process quality audits must be planned in order to anticipate problems rather than wait for them to suddenly blossom into a major headache.

To complete the cycle, when production is underway, information is constantly fed back to quality control engineering for analysis and new planning. This appears in the form of:

Quality of incoming material and in-process checks;
Process capabilities;
Special inspection studies, and
Final quality audits.

If we review the character of the quality control engineering function, very quickly again, we can see how readily it fits into the activities just described.

The systems engineering aspect is fairly obvious with the feedback principle and the nature of its high technical content.

Equipment design, inspection and test methods, and statistical methods are fundamental to the quality control function.

In addition, management engineering and personnel relations have a similar connotation here. As we see it, quality control engineering has a lot to offer and holds a commanding position in running a sound business. It is essentially a management activity. As it cuts across many organizational lines, tactfulness and diplomacy need to be very much in evidence.

The requirements of the test and inspection activities of modern quality control are also not without their differences when compared with historical methods. In reality, inspection and test should be the means for extending quality control engineering plans to the shop floor. Since the purpose of modern quality control is "to make it right the first time" and not merely to separate good parts from bad, inspection and test activities become essentially the means of explaining the why and how of good quality practices and also the instrument for auditing the results.

This requires much more skill than we have usually accorded this group. As a result, they must be proficient in the use of measurement equipment, in its maintenance and calibration, in addition to being familiar with the use of basic statistical methods.

Coupled with the monitoring of the quality assurance plan is the all-important responsibility for feeding data back to quality control engineering for new planning, thus completing the cycle.

It might very well be that modern quality control, in terms of its objectives, organization and type of personnel may appear to many of you as a concept for the future. Let me assure you that this couldn't be further from the truth.

While industry has not achieved a very high level of automation as yet, its degree of mechanization is certainly advanced. At the same time, industry is still largely a slave of its technology rather than its master. For all our high-powered engineering skill and elaborate machinery, maximum effectiveness of their use falls far short of the possibilities. And this is so because we do not fully understand how all the ingredients combine and work in the most efficient manner. Most of us still go about things on a trial and error basis. In contrast, an effective quality control program can make a positive, productive contribution—right now—but it certainly mustn't be confused with the relatively ineffectual bits and pieces by which quality control is still largely recognized.

If we ever hope to achieve any degree of automation, the need for modern quality control takes on tremendous significance. Automation requires far tighter controls over incoming material quality and over in-process quality; it requires the development of far more effective inspection and test measuring and feedback devices; it requires far better procedures for determining the quality-ability of new designs prior to the start of production, rather than after mountains of rejects have been produced; it will, certainly, require the creation and use of far higher levels of quality control engineering technology.

While automation may not be here yet to any great extent, examples of partial automation are already on the scene. Those that have wrestled with the problem know the meaning of quality control, very often as a result of a severe lesson. To achieve automation we must rely on quality control particularly when we consider the automatic measuring equipment which is integrated with the automatic manufacturing process.

Perhaps the title assigned to this paper may be a misnomer in that very little mention was made of how to train people for modern and effective quality control. There are many methods to acquire a top quality control team. In large part, the methods used will depend on the type of business, its size, the time allowed, and certainly many other factors. Each method in its own way can prove effective, but we at General Electric feel that modern quality control is the only concept that can be used as an objective.

In our training activities we prepare people for quality control work with material developed along these subjects:

For quality control engineering, we include methods for thoroughly analyzing quality costs, breaking these costs out into three important areas:

1. Prevention Costs — the costs expended in an effort to prevent poor quality;
2. Appraisal Costs — which are the dollars spent for assuring the quality of the product; and
3. Failure Costs — which are extra charges for products not meeting quality standards the first time.

With this kind of an analysis, our people are trained in the methods of programming their quality activity and measuring the results of their efforts.

In addition, we include, among other subjects for the quality control engineer's training, quality systems engineering which integrates the quality activity from marketing and design to shipping. Also, pre-produc-

. . . *Continued on Page 145*

For Better Brazing Start with the Fundamentals

by Lester F. Spencer
Consultant
West Allis, Wisconsin

BRAZING CAN BE DEFINED as a metal joining operation performed in the temperature range between those used for welding and soft soldering. The Research Division of The American Platinum Works has very aptly differentiated between a brazing operation and a welding operation in that the former exhibits the following characteristics: (a) the base metal is not melted during the bonding operation; (b) the brazing alloy flows into a joint by a phenomenon known as "capillary attraction"; and (c) the brazing alloy is a non-ferrous alloy of a composition other than that of the metal being joined. In addition, soft soldering is similar to brazing with the exception that it is performed at a lower temperature (below 800°F) at which less bonding occurs between the solder and the metal being joined.[1]

A variety of brazing methods are available, these methods being classified in accordance to the means of heating. These will include torch brazing, dip brazing, induction brazing, furnace brazing, and the somewhat less-known incandescent carbon and electrical resistance brazing procedures. Regardless of the method chosen for brazing, there are certain fundamentals of the brazing operation that will affect those properties of strength and ductility.

In order to obtain maximum strength of joint, the question of clearance is of importance. Thus, to obtain the required "capillary" flow to the full depth of the joint, the clearance (thickness of joint) should be between 0.001″ and 0.003″. As indicated by the tensile or "breaking" strength of a bonded joint, Figure 1, the clearance value stated above will permit high strength. Beyond this value, strength decreases rapidly. There may be deviations of the recommended clearance values given, due

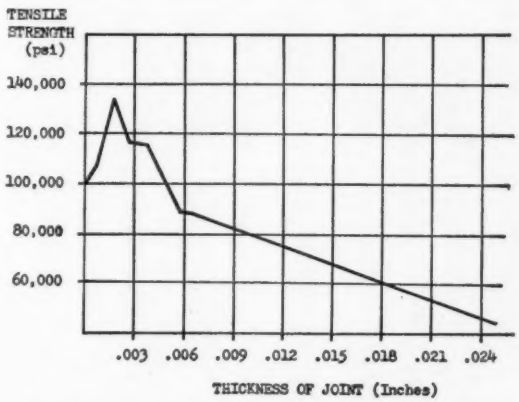
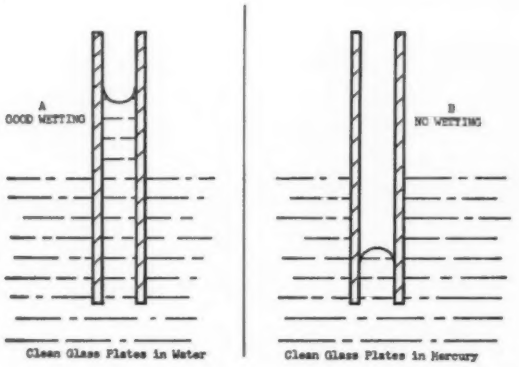


Fig. 1. Relationship between joint thickness and tensile strength based upon butt joints of stainless steel brazed with a silver solder alloy. Tensile strength will vary with other metals; however, the results above typify what can be expected in silver brazed joints. Close clearances make the strongest joints.[1]

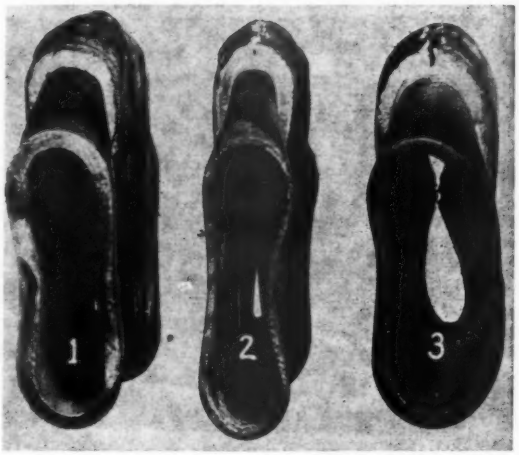


Courtesy, Handy and Harman

Fig. 2. Wetting and capillary attraction work hand in hand.

to differential expansions and contractions in the joining of dissimilar metals. On the basis of properly made joints, the data given in Table 1 illustrates effectively the relatively high strength that is obtained in the brazed joint as compared to the tensile strength of the base metal.

In order to illustrate what is meant by "capillary attraction", let us consider the illustration given in Figure 2. In this simple experiment described by Webber,[2] if two glass plates are held closely together as illustrated in A, the water will wet the glass and rise in the column between the plates — the closer the plates, the higher the column. However, if the glass plates are immersed in mercury, no wetting takes place and a depressed column will appear, as indicated in B. The point illustrated is that for the desired liquid creep of a molten brazing alloy within a joint, the first requirement is that of "wetting"; this is obtained by having a thoroughly clean joint interface. In addition, the extent of creep of a molten brazing alloy is increased as the joint clearance decreases to an optimum value. Fortunately, due to such circumstances as alloy type, joint design and procedures, the required wetting action is frequently assured by the use of fluxes.



Courtesy, Handy and Harman

Fig. 3. In this test to determine the relative strength of brazed joints, failure occurred in the material rather than the brazed joint.

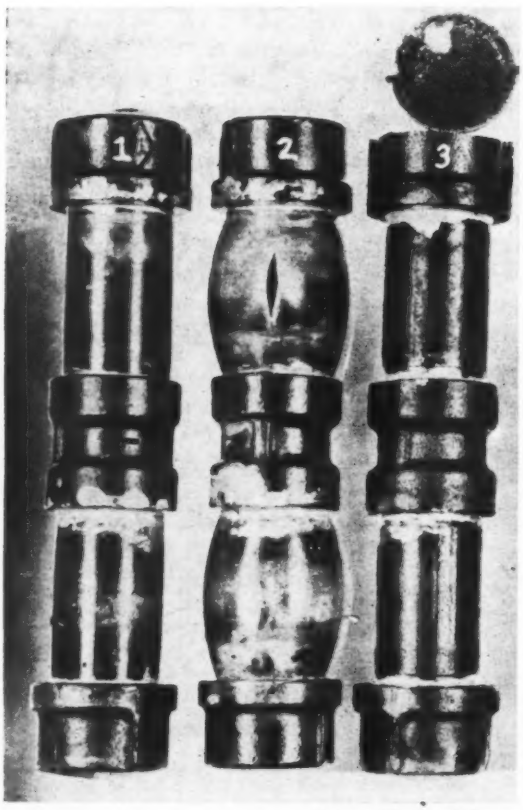
Table I—Strength of Silver Brazed Joints[1]

Metals Joined	Size of Test Piece	Yield Strength of Base Material psi	Tensile Strength of Base Material psi	Yield Strength, Brazed Testpiece psi	Tensile Strength, Brazed Testpiece psi
Annealed Copper*	½" dia	11,000	34,000	10,000	33,000
Armco Iron*	½" dia	40,000	53,500	41,500	52,000
SAE 1020 Steel**	½" dia	50,000	70,000	53,000	65,000
Drill Rod, Annealed	½" dia	65,000	95,000	64,000	83,000

*Brazed joint broke outside of joint.

**Broke in joint; however, breaking strength is higher than yield strength of solid metal.

To illustrate the ability of a brazing alloy to impart both ductility and pressure tightness to a joint, the tests illustrated in Figures 3 and 4 are given. Thus, in a flattening test, the results of which are shown in Figure 3, a 1½" pipe or tubing with nipples 2" long were silver brazed to both ends of a 45° and a 90° ell. In each case



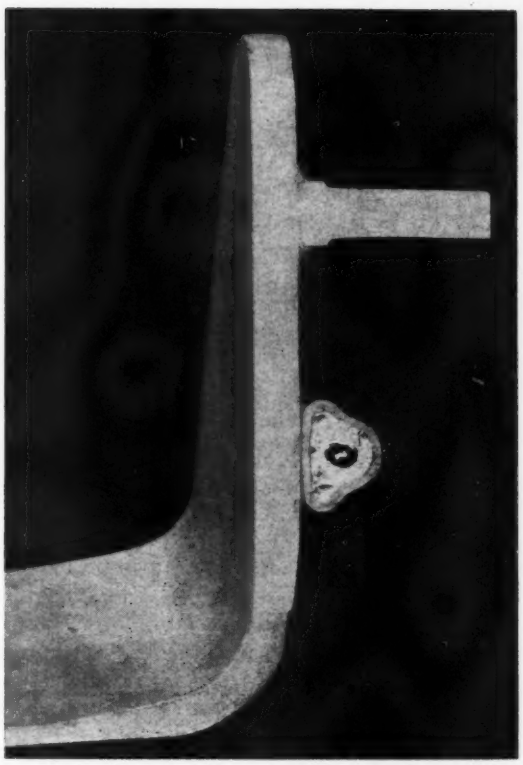
Courtesy, Handy and Harman

Fig. 4. In determining the relative strength of a brazed joint, the above brazed pipe assemblies were hydrostatically tested.

the fitting or the pipe cracked whereas the brazed joint remained intact. Specimen No. 1 represents the brazing of brass to brass; specimen No. 2 is brass to naval bronze tubing; and specimen No. 3 consists of malleable iron pipe and fittings. In hydrostatic test of brazed pipe assemblies, as illustrated in Figure 4, the brazed joint remained intact in all three tests. Thus, specimen No. 1 represents the brazing of brass to brass, with failure occurring at the 5,000-lb pressure level; with specimen No. 2, brass to naval bronze tubing, failure occurred at the 2,500-lb pressure level; and specimen No. 3, consisting of malleable iron pipe and fittings, failed at a pressure level of 8,500 lbs.

The brazing alloy and method of application of this filler material, joint design, material to be joined, the choice of brazing method and the procedures to follow in a brazing operation are of equal importance. In regard to procedures recommended for a brazing operation, the three basic steps would include (a) cleaning of the work for brazing; (b) fluxing of both the work and the brazing alloy; and, (c) the assembly of the parts to be brazed and the brazing alloy in preparation for the application of a heating medium to produce the joint.

In order to obtain a sound, leak-tight joint, the brazing alloy must wet and flow freely over the entire surface of the facing metals within the joint area. To ensure this the metal surfaces must be free of dirt, grease and oxides. Proper cleaning is usually a simple procedure. A classic example[1] of this is sheet metal or tubing which, as it comes from the mill, is not usually clean enough for brazing and requires additional operations in the form of filing, grinding, sandblasting or chemical cleaning.



Courtesy, Selas Corp. of America

Fig. 5. Cutaway section of a satisfactory brazed joint in a cast aluminum alloy.

Oil and grease can be removed with carbon tetrachloride,* hot soda bath, trichlorethylene, or vapor degreasing. Burrs and sharp edges, which may form a barrier to the free flowing characteristics of the brazing alloy, should be removed.

*Considered toxic by various safety codes and prohibited from use in some states.

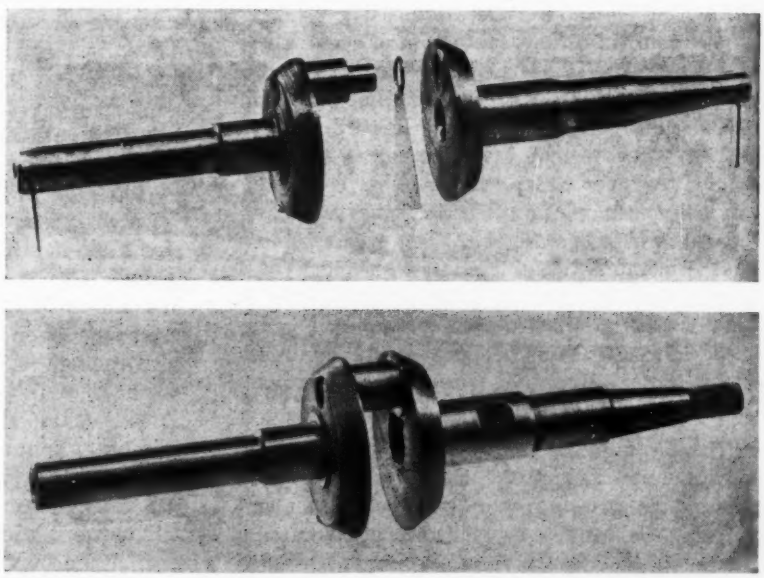


Fig. 6. This is an excellent example of cost savings by simplification of operations. One ring of silver solder wire is preplaced to join these crankshaft components in 25 sec. Considerable savings are gained by employing this method rather than the former one-piece forging, since the two sections can be machined separately at lower cost.

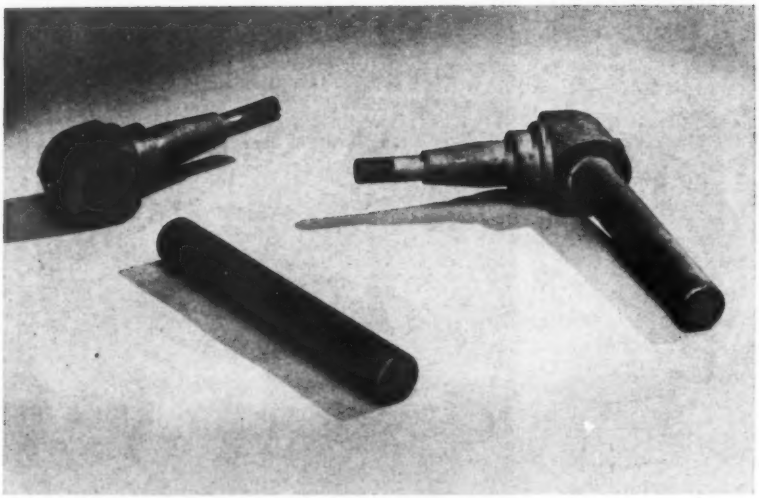


Fig. 7. A simplified forging and a rod are now silver brazed to produce the kingpin and axle for use as a tractor part. Note the two 1/16" grooves in the rod where the silver brazing alloy rings are pre-placed. This part is induction brazed in 60 sec.

Courtesy, Selas Corp. of America

In the event that the cast iron to be brazed has an appreciable quantity of graphite present, as exemplified in gray cast iron, the Kolene molten salt electrolysis process of cleaning offers many advantages. When this procedure is used, gray cast iron can be as easily brazed as any other metal.

With a few exceptions, fluxing is required to assure the proper flow of the brazing alloy. The flux protects the metal surfaces during heating and also serves to dissolve and absorb oxides which may form during the heating operation. This latter characteristic is of prime importance since the conventional brazing alloys will not wet or flow over oxidized surfaces.

The flux should cover completely the metal surfaces surrounding the joint. Anhydrous borax or a mixture of anhydrous borax and boric acid is widely used where the brazing filler metal is either copper or a brass; steel assemblies are brazed with copper filler metal at 2050°F, while the use of a brass composition filler metal requires a temperature around 1675°. Cryolite may also be used as a fluxing agent; however, since this material is slightly corrosive, removal immediately after a brazing operation is recommended. The alkali biflourides in combination with borax and boric acid can be used as a fluxing agent in the joining of metals that have refractory oxides such as are experienced in the brazing of the stainless steels, the aluminum bronzes, the silicon bronzes, and beryllium copper.

The fluxing agent can be applied either as a powder, liquid or paste. Both the powder and paste form usually require mixing with alcohol or water so that ease of application can be realized. The flux is then applied to the joint area by brush, or the preformed brazing alloy can be dipped into the flux and then applied to the joint.

Metal that is not cleaned properly will not flux satisfactorily and may result in bare spots over which the brazing alloy will not flow. In addition, the design should be carefully considered so that flux entrapment will not occur as the brazing alloy flows into a joint. If this is not done, there may be flux inclusions within the joint which ultimately will result in pin holes and voids. This fact is of particular importance where the joint must be liquid or gas tight. Where the finish is important, oxidation and discoloration can be minimized by applying the flux to the areas adjacent to the joints, or the entire assembly may be covered. This leaves little cleaning to be done other than washing off the residual flux in hot water after brazing has been completed. The fluxing operation should be done immediately before the parts are brazed, since the flux will dry out if allowed to stand and may crack or be knocked off during handling. In some instances, as in hand feeding the braze material in torch heating, the brazing wire should also be fluxed to protect it from oxidation.

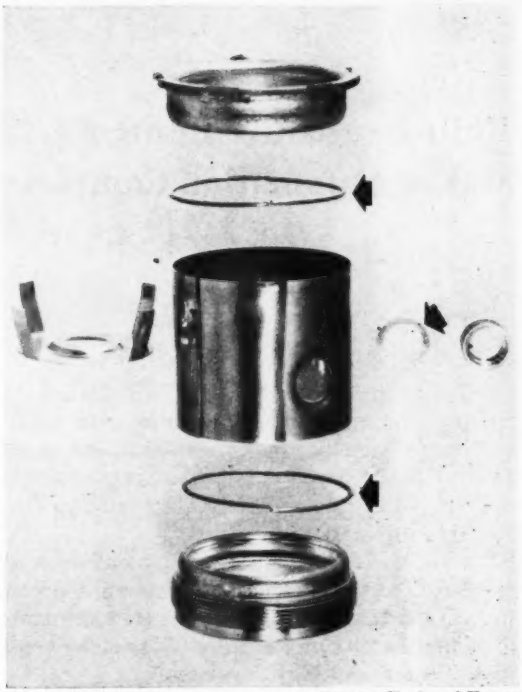
During assembly, the individual workpieces should be handled carefully and the unit to be brazed held securely until the brazing alloy has solidified. Pre-formed alloys should be used whenever possible. Parts designed to be self-jigging are preferred; however, other methods of jigging can be used to advantage. These include spot and tack welding, staking, crimping, spinning, expanding, pinning, bolting, or the use of jigs and fixtures.

It is essential that in considering a new technique, a new application of brazing, or, even as a production tool, the brazing operation

be evaluated. This can easily be done by cutting a sample joint to determine both penetration and continuity of the brazing alloy. An example of this is shown in Figure 5, the cut section revealing the brazing of an encased electrical heating element to an "as cast" aluminum shell. The brazed joint in this case is satisfactory. Upon a critical evaluation of a brazed joint, the operation may be altered if required to obtain the desired results.

The suggestions given below are the salient features, precautions and characteristics of silver brazed joints considered[1] by the Research Division of The American Platinum Works to be helpful in obtaining satisfactory bonding:

1. During the heating phase, allow for the heat capacities and probable heat losses of each component part within the assembly. Heat evenly and rapidly to the brazing temperature. Do not heat more than necessary.
2. Flux the joint evenly over the entire area that is to be heated. Too much flux will hinder the efficient transfer of heat to the work. If the flux should melt before the work is brought to the brazing temperature, the flux may ball up and will not form a protective film over the work as it melts. This will expose many areas to objectionable oxidation and may hinder the production of a sound joint.
3. It should be realized that some voids may occur in alloy films on joints with relatively large areas; however, they should be kept to a minimum and as small as possible.
4. Natural, smooth continuous fillets should be formed at the joint boundaries.
5. The use of pre-placed alloy whenever possible is recommended for effective and efficient use of the brazing alloy, this being especially true where the more expensive high silver content brazing alloys are employed.
6. If possible, feed the alloy at one boundary and then through the joint until it appears at the opposite boundary.
7. When an enclosed joint is used, pre-place the alloy from the inside so that it will flow out until visible.
8. Establish a design so that ports or openings are provided for the escape of gases from enclosed pockets that may form during brazing.
9. In the event that difficult-to-braze metals are encountered, pre-tinning frequently proves to be an aid in establishing sound joints.



Courtesy, Handy and Harman

Fig. 8. These easily and inexpensively produced components are joined by brazing to produce a low-cost thermostatic expansion valve spacer. Three rings of pre-placed brazing alloy (arrows) are used to join the stainless steel shell to the brass fittings.

There are innumerable examples where brazing has cut production costs; the avenues of approach being (a) the use of a more simplified and less costly procedure to produce the individual component parts within an assembly (Thus, a rocker-arm shaft bracket for aircraft engines, which was formerly cast to shape, is now produced from several stampings. Likewise, a forged automobile shock absorber can now be produced from simplified machined parts, stampings and tubing.); (b) the combining of operations, which is frequently done in salt bath brazing, where the bath serves a dual function of brazing and carburizing, or brazing and hardening; and, (c) by the use of mechanized equipment to obtain greater productivity per man-hour.

end

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1. "A Complete Guide to Successful Silver Brazing", The American Platium Works.
2. "Furnace Brazing of Machine Parts", by H. M. Webber, MECHANICAL ENGINEERING, Nov. and Dec. 1950.
3. "Easy Flo and Sil Foe", Bulletin No. 20, Handy and Harman.
4. "A Comparison of Heating Methods for Brazing", by L. F. Spencer, STEEL PROCESSING, Dec. 1951 and Jan. 1952.

COMING SOON

Basic Factors in Brazing Alloy Selection and Joint Design

Built-In Quality Control Makes Automation Complete

A VITAL FACTOR IN THE TREND toward complete automation is the widespread application of automatic measurement to all types of equipment, from partially automated single machine tools to completely automatic and integrated production lines.

Intensive research and development work at the Sheffield Corporation is producing a growing variety and volume of integrated automatic dimensional control units, as well as complete "Autometrology" systems.

To provide complete control, each system includes a cartridge or size sensing element, plus indicating and amplifying components. On machine tools, most systems are of the air type, utilizing pneumatic-electric or pneumatic-electronic amplification.

The automation applications involve the gaging of either location or size, with the information fed back to provide in-process or post-process control, or for use in final inspection, assembly operations, or parts straightening.

In-process control provides for automatic control through feedback from the sensing element as it gages the workpiece during forming (Fig. 1).

Post-process or station is performed immediately after machining or forming at a point either adjacent to the tooling or at some remote point (Fig. 2).

Final inspection can also be carried out automatically. An example of this function, combined with parts assembly, is the inspection and assembly machine shown in Figure 3. This automatic machine assembles and inspects 1,000 tapered roller bearings per hr. Each assembly consists of an inner race, 18 rollers, and a cage. Another new use involves the automatic straightening of parts that have been rejected because of distortion.

With the ultimate and inevitable link-up of built-in quality control with central "brains" or computers, Sheffield's Autometrology specialists believe, completely automatic control of an entire factory can be accomplished — possibly in the very near future. end

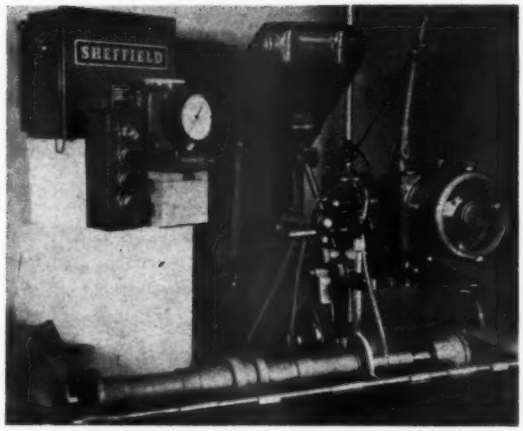


Fig. 1. A pneumatic-electric gage is used on this crankpin grinder to measure diametral size automatically during grinding. The gage initiates signals for changing wheel feed from fast to slow and to retract the wheel at final size. Part size is visually indicated and read directly.

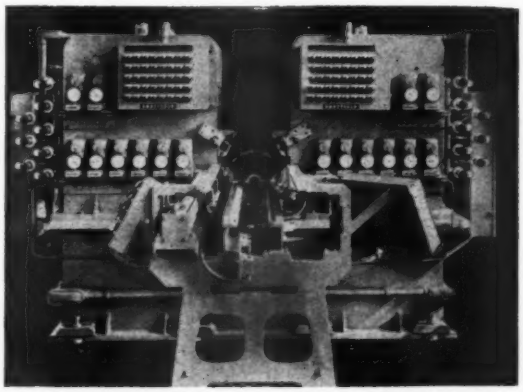


Fig. 2. Sixteen valve lifter holes in a V-8 engine block are checked for size simultaneously at two places each on this automatic gaging machine which is normally located right in the production line. If bores are too large or too small, the gage feeds back signals that shut down the machine that produced the faulty dimension. Hole size including the amount of out-of-tolerance is visually indicated and read directly.

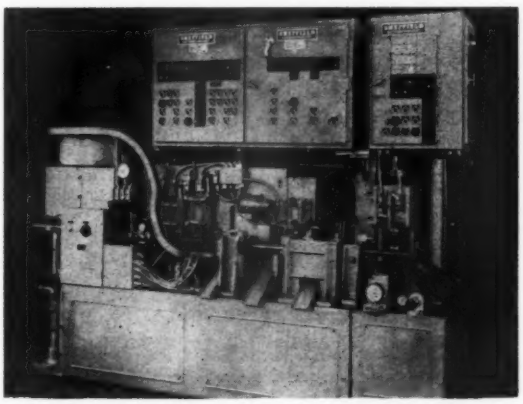


Fig. 3. Completely automatic assembly and inspection of 1,000 taper roller bearings per hr is performed on this progressive type assembly machine. It gages the diameter and flange thickness of the inner race, selects the proper roller size, and assembles them with a cage. The assembled bearings are then gaged for torque and "standout" before leaving the machine.

For Accuracy & Economy . . .

MULTIPLE DRILLING WITH AIR-FED GUN DRILLS

by Norman W. Cote
Assistant Chief
Process and Development Engineer
LYCOMING DIVISION
Avco Manufacturing Corporation

The success of this initial machine has spurred the development of a design to gun drill deep holes, six at a time and at compound angles.

CLOSE INTER-RELATED TOLERANCES—as close as one-thousandth total accumulated error—require that locating holes be produced to unusual accuracy.

The supercharger rear cover of the R-1820 nine-cylinder radial aircraft engine, manufactured by Lycoming, requires over 70 machining operations, most of which are tied-in to two locating (tooling) holes.

After initial efforts to drill these holes with a conventional radial drill set-up using twist drills were found unsatisfactory, an analysis indicated errors to be caused by: rapid dulling of drills in the magnesium sand castings, inaccurate centering of the drill spindle relative to the bushing, insufficient cutting oil reaching the drill point, chip packing caused by infrequent drill retraction, as well as the use of improper feeds and speeds by the operator.

In the same manner, finishing with precision carbide shaving reamers in floating holders tended to aggravate the already out-of-tolerance hole condition.

To overcome these difficulties and produce usable locating holes, it was determined that

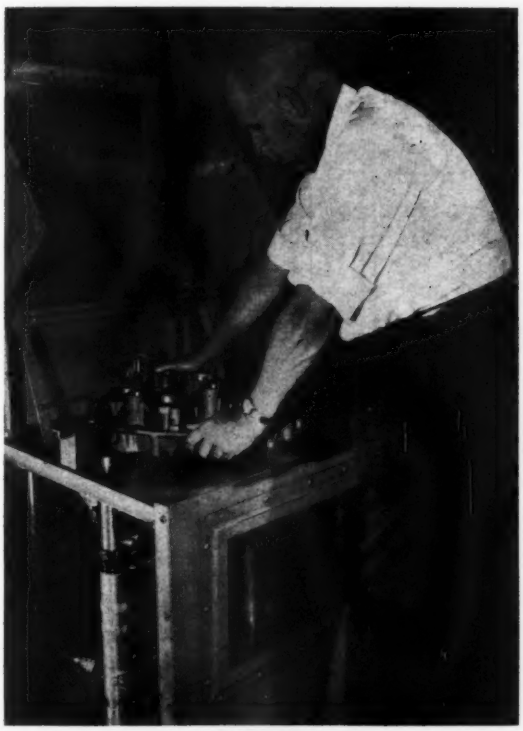


FIGURE A

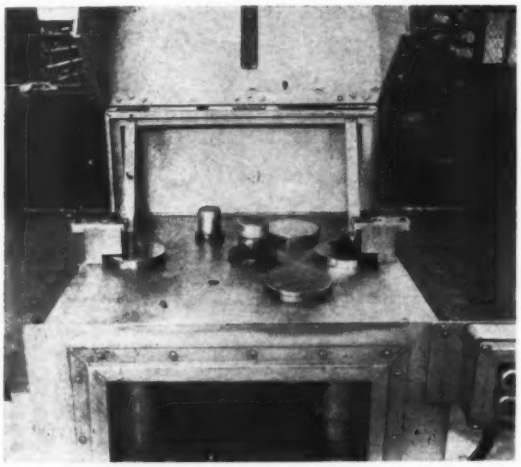


Fig. B. Before Loading

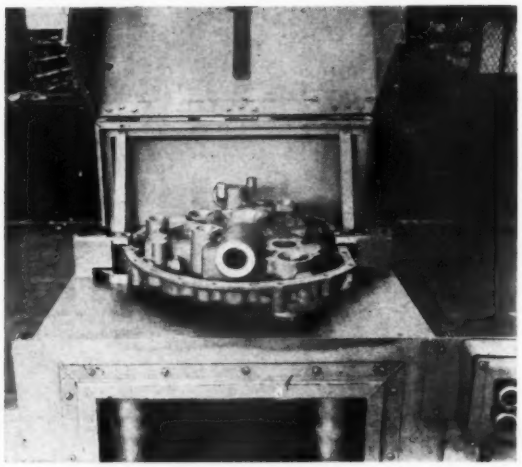
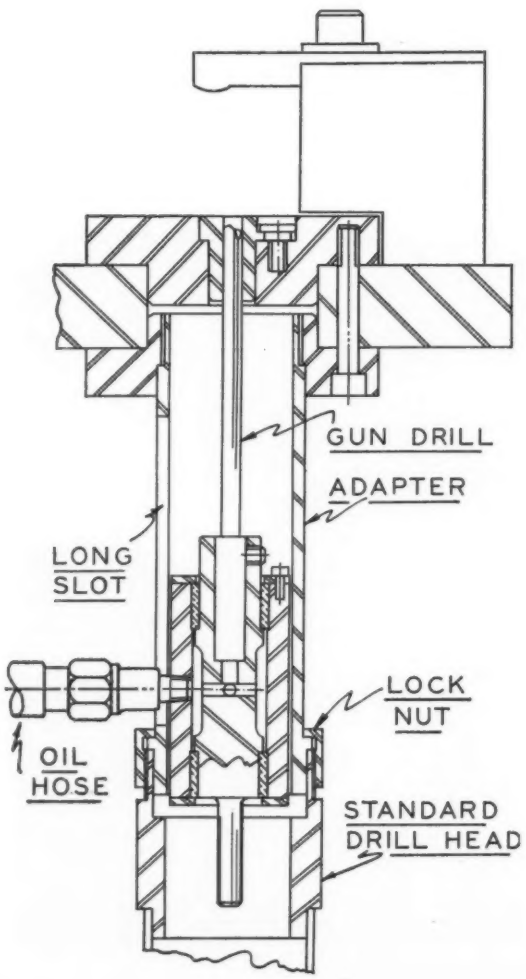


Fig. C. After Loading

a new method must be devised to achieve the following:

1. Produce holes to within .0005" of true position, consistently.



2. "Drill" holes to a diameter having only .0005" total tolerance, or less, with a maximum surface roughness of 80 rms.

3. Increase cutter life.

4. Furnish cutting oil to the drill point at all times.

5. Remove feed and speed setting from the operator's control.

6. Pre-position spindle alignment with bushings.

7. Provide safety interlock to eliminate running drills dry, which could lead to a fire hazard.

8. Provide for easy loading and unloading.

9. Minimize fixture cleaning time.

10. Reduce manufacturing time.

These objectives have been fully met by combining an old art, gun drilling, with a relatively new power source, Keller Airfeedrills. Figure A shows the special machine designed for this job.

The machine's basic member is a horizontal table that is ground to the required flatness and parallelism. On this table are mounted four disc-shaped rest pads and two rough-locator plugs to receive the part in properly oriented position. These are shown in Figure B. The plugs correspond in size and position to two holes in the part that have been reamed in a preliminary targeting operation. Two of the rest pads (at left and right in Fig. B) carry drill bushings in proper relation to the locating holes to be gun drilled.

As detailed in Figure D, the two drilling heads are located permanently under these

Fig. D. Sectional drawing showing the method of adapting the standard air-feed drill unit and of inducting oil into the gun drill. Please see number 2 of Fig. E.

two discs in exact alignment for squareness and concentricity with the drill bushings. As indicated, the drilling action is upward. Bushing heads are ground to provide a tight oil-seal against the part, causing chips and cutting oil under high pressure to be ejected down along the drill flute and into the sump.

Cutting thrusts are small in this setup and are easily resisted by the clamps located directly over the drill heads. Slots are provided in the clamps for clearance of the carbide gun drills when they break through the work.

Figure E shows a rear view of the machine with splash panel removed. The drilling head (1) has an adapter assembly that is threaded to a support bracket on the lower face of the machine table. This adapter assembly incorporates a simple rotary oil inductor (2) of Lycoming design interposed between drill spindle and gun drill. The oil sump (3) is seen below.

Cutting oil is furnished by a 6-gpm pump (4) driven by a 3-hp motor. The oil is drawn from the baffled pump through a fine edge-type chip separator (5) to prevent damage to the pump vanes. Operating pressure is set at 750 psi to guarantee positive chip ejection, despite the fact that 250 psi had proved sufficient under normal cutting conditions. Oil flow averages about 2-gpm total for both drills. Excess oil is returned to the sump via the preset pressure relief valve (6).

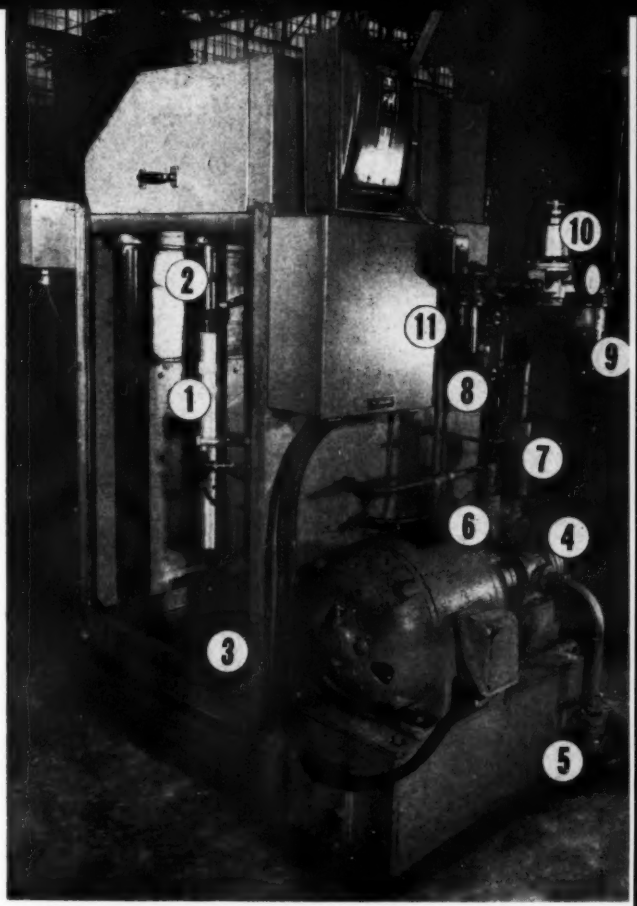


Fig. E. Rear view of gun drilling machine with side splash panel removed.

For details of another gun drilling application, see "Fixturing Boosts Gun Drilling into Automatic Production", TOOLING & PRODUCTION, March 1957, p. 79.

The machine operates as follows: The workpiece is located on the two plugs using holes reamed in a previous operation and is seated on the discs or rest pads. Then it is clamped. The counter-balanced hood is lowered, to shield the operator from oil spray as the drills break through. Pushing the start button starts the cutting oil pressure build-up which in turn causes the pre-loaded sequence piston (7) to move upward at 450 psi pressure. This piston actuates the starting air valve (8), starting drill rotation and thrust pressure to the drill heads. Each drill head then drills for its predetermined stroke, retracts and stops rotating. Pushing the stop button stops the machine and oil flow for part removal.

Should oil pressure drop below the pre-load of 450 psi for any reason such as electrical failure or clogging of the supply line, the safety interlock will immediately retract the drills, thereby preventing fire or work spoilage.

The air supply required for rotating and feeding the drill units is filtered (9), regulated (10), and oiled (11) to insure optimum performance.

Plastic windows are provided in both hood and front panel so that the operator can watch chip ejection during operation. A change in size or volume of chips would indicate need for correction of cutting action before damage could occur.

The high pressure cooling and lubrication furnished here has resulted in long life for the carbide cutting edges and the bushings, and no noticeable work heating.

The drill heads are operated at 3600 rpm to prevent whip of the drills. Feed is .0025″/rev giving a feed rate of 9 ipm or 16 sec drilling time for the 2½″ depth of hole.

Hole diameters have been held consistently to 0.0003″ total tolerance as measured by air plug, and have a surface finish of 8 to 12 rms.

Due to the excellent results achieved with this initial machine, several additional units are being set up to gun drill small-diameter deep holes at compound angles, in groups of up to six at a time.

end

Laboratory Control of Surface Quality and Geometry

by Douglas T. Peden
Vice President, Research & Development
MICROMATIC HONE CORPORATION
Detroit, Michigan

The generation of finer and finer surfaces along with increasingly accurate geometrical shapes poses a challenge in devising methods for measuring the results. Here is the laboratory setup whereby Micromatic Hone Corporation keeps on top of their progress in the art of honing.

SINCE THE INVENTION OF THE WHEEL at the beginning of the mechanical age it has been man's insatiable desire to better himself. It was the advent of the automatic machinery and its intensive development over the years that has brought about many things that have made life easier for man. Things do not occur by just waving a magic wand and wishing it so. They are here only because of man's unceasing efforts to produce more things at lower cost which allows more time for enjoying the fruits of his labors.

We at Micromatic fully subscribe to these concepts. In the last quarter century we have seen the greatest technical advances made in the metal cutting field. An outstanding example of which is the use of area contact abrasives which are used by the Microhoning process. The full utilization of this technique engenders bore geometry which by any other method becomes time-consuming and costly.

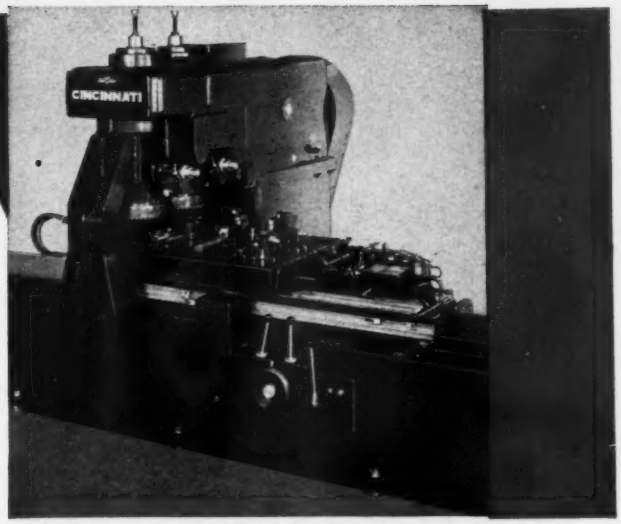
The Microhoning process performs a twofold duty of not only generating geometrically accurate surfaces but applies to the surface a controlled degree of roughness as well as characteristics best suited to the longevity of the mating parts. These results improve the quality while reducing the cutting costs in the finished bores.

We have found that the tendency on the part of manufacturers has been to reduce tolerances, and in many instances the use of Microhoning has made possible this reduction by producing bores which are automatically sized at high-production rates and lower costs. Some present-day tolerances are specified in millionths of an inch which certainly fall in the high-precision class. At Micromatic we have held tolerances to fifteen millionths total bore error which we believe can enjoy high production rates as well as excellent economy.

Due to the growing necessity for tolerances of this nature as related to their usage, accurate bores are assuredly not a manufacturing luxury. In years past accurate bores were considered a luxury, the same as the automobile, but time changes all things. Luxuries of yesteryear are a necessity today; the availability of Microhoning to manufacturing requirements for producing more accurate bores, better finishes and stock-removing economies — along with better mating parts and longer life, lower costs and higher production rates — mean necessity, not luxury.

Along with the never-ceasing endeavor through research and development to promote more efficient usage for the area contact abrasive, we have found that the end result is not

Easy on your Replacement Fund---



HyPowermatic with 50 hp main drive and two vertical spindles in a fixed housing, tooled up to mill the top and combustion face on cylinder heads. Many standard HyPowermatic units and features are incorporated in this machine.

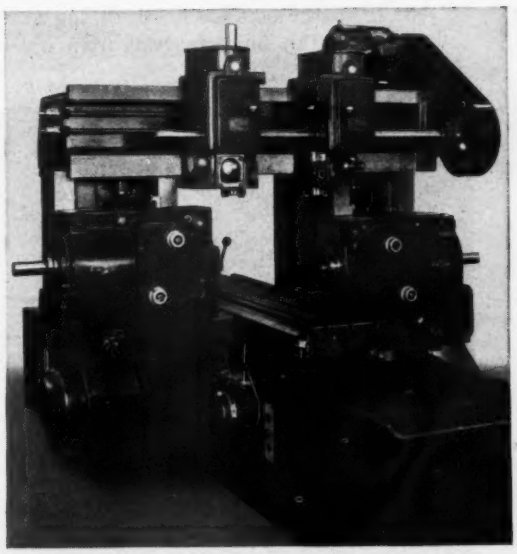
Cincinnati HyPowermatic Unit Construction Plan

Don't discard new production milling ideas as being too costly without considering Cincinnati's HyPowermatic unit construction plan. You may find that a special machine is entirely unnecessary. HyPowermatics are assembled from standard and complementary units to give you unusual combinations such as:

1) Close-coupled spindle carriers
2) Vertical and angular spindle heads; many styles and combinations, including adjustable angle
3) Ram mounted spindle heads
4) Fixed height or adjustable bridge type rail support for vertical spindle heads

Take a look at the heavy duty automatic milling machines in your shop which may have become productively obsolete. You may be surprised to see how much you can gain—in production and lower unit cost—by replacing with CINCINNATI® HyPowermatics, built up with standard and complementary units to suit the job. They offer many cost-cutting replacement possibilities. May we send you a copy of the new, fully illustrated catalog? For brief specs, look in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



HyPowermatic, duplex style, equipped with highly useful complementary units consisting of two additional spindle heads mounted vertically on a cross rail. This HyPowermatic can mill simultaneously the sides and top of box-shaped parts.

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Plain HyPowermatic
MILLING MACHINE
Duplex and Tracer Controlled styles available 42 sizes of each.
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CIRCLE INFORM-A-GRAM KEY NO. 109

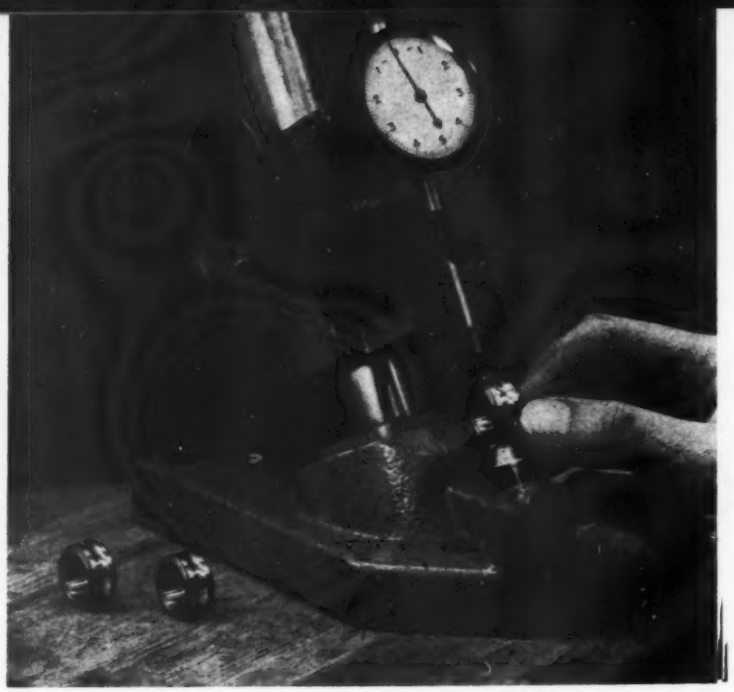

Fig. 1. This dial gage setup is equipped with ball-tipped anvil and spindle, equal in radius to the cross-sectional radius of the ball track. After being "zeroed" by a master, it measures variations in ball track diameters in "tenths".

definitely established unless we have a means of checking either from the standpoint of geometry or from the surface finish of the abraded surfaces. In the final analysis man produces many things, but the success of his labors can only be established by the equipment which gages his results and lets him know how well he has done.

Fig. 2. The Wavometer indicates any waviness around the circumference of the ball track in microinches RMS. The oscilloscope gives a "view" of the number of waves around the track.

This is true in our laboratory where our equipment determines the success of our research projects. An example of this could be the project for honing the ball track surfaces of the inner and outer rings in ball bearing assemblies. These surfaces have been highly refined from the standpoint of surface finish; the ball track radius has been generated to accuracies of millionths of an inch, and the waviness of the surface circumferentially has been reduced considerably.

Let us take the inner ring ball track as a case in point and go through the final gaging steps necessary to establish the success of the operation. Step 1 could be for the diametral size of the ball track itself. This is usually found by using a gage stand, Figure 1, having a dial indicator graduated in ten-thousandths and passing the ball track through an anvil on the stand having a ball tip on it. The stem of the indicator would establish the size of the track itself, taking for granted the gage was set from a master to start with. This also could be done by the use of air gaging.

The second test might be the check for waviness of the surface and we would use the Wavometer, Figure 2, manufactured by the

Micrometrical Manufacturing Company. This establishes the waviness of the surface in micro-inches RMS. The low band meter dial shows the amplitude of the widely spaced waves on the circumference in the range of from 4 to 17 micro-inches. The high band range indicates the amplitude of the closely spaced waves from 17 to 150 micro-inches per circumference. From the oscilloscope on this machine we can determine the number of major waves per circumference, and the character of either the widely spaced or closely spaced waves, by means of a selector switch.

To establish the surface roughness we would use the Rotarypiloter, Figure 3, made by this same company. This piece of gaging equipment uses a stylus which travels the radius of the ball track at right angles to the path of travel of the ball. This is used in conjunction with the Profilometer which registers in RMS values or arithmetical values the surface finish itself.

For a final check of this track we would use our Talyrond machine, Figure 4, distributed by Engis Equipment Co. First we would set the stylus to travel the ball track radius, after which we can produce a polar graph, Figure 5, of this surface from which we can tell directly the deviation from truth in millionths of an inch, hence the successful generation of this surface. By resetting this machine to allow the stylus to pass around the circumference of this track, we are able to establish geometrically the accuracy within millionths and see any defined waviness.

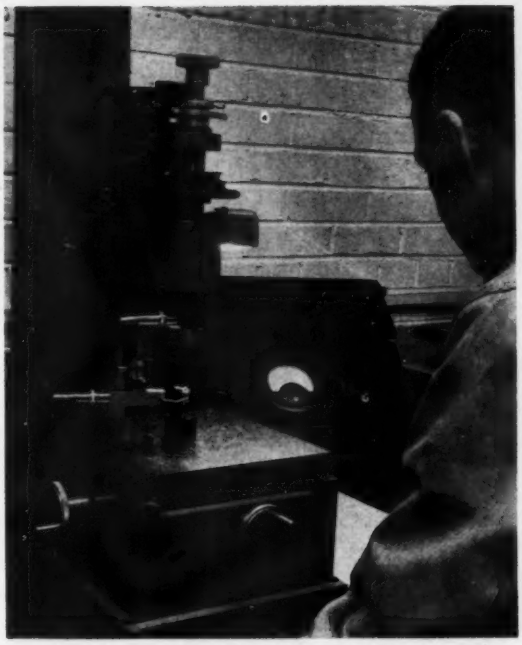

Fig. 3. The contact point of the "Rotopiloter" traces across the ball track and gives a Profilometer reading of the surface roughness. The setup is made so that the center of revolution of the Rotopiloter spindle coincides with the center of the cross-sectional radius of the ball track.

Another geometric check we often make is to establish the concentricity of the ball track with the bearing bore. In determining this function we use a tapered arbor, slip the bearing on it and place it between centers, Figure 6, and use a Sheffield air test indicator in con-

Fig. 4. The Talyrond equipment traces a polar graph (center, left, of machine head) of the geometry of the track. It can be set to trace either the radius or circumference of the ball track.

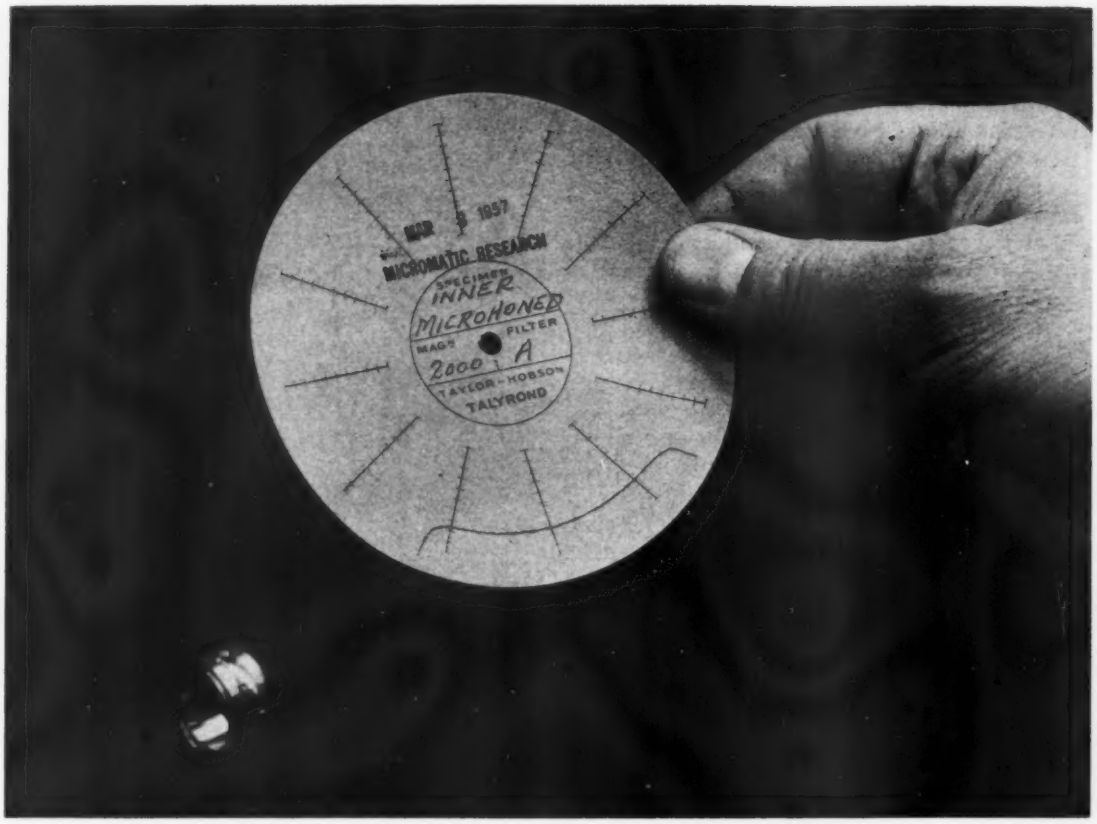

Fig. 5. A Talyrond graph taken across the track of a Microhoned ball track. Any departure from geometrical truth is readable in millionths of an inch.

Fig. 6. This Precisionaire setup is to determine the concentricity of the ball track with the bearing bore.

junction with their Precisionaire column instrument. This accurately shows in fractions of ten-thousandths how concentric these surfaces are. It has been found in our laboratory that the use of mechanical indicators to check concentricity is not an accurate method because of the inertia in the indicator itself. Therefore, we have set our procedures to use this air test equipment.

In our laboratory and shop work we use many forms of air gages, and we use also the dial-type gages in checking diametral changes in long bores. In checking the quality of surface finishes we use in our laboratory both Micrometrical's Profilometer and the Surfindicator which is made by the Brush Development Company. Both instruments will take surface roughness measurements in root mean square or arithmetic average micro-inches. All of these instruments and more are necessary in evaluating the fine order of accomplishment produced by the Microhoning process.

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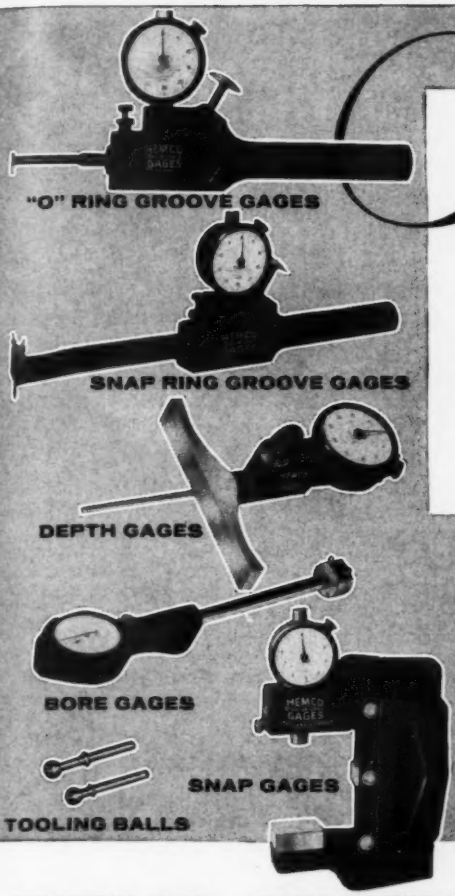

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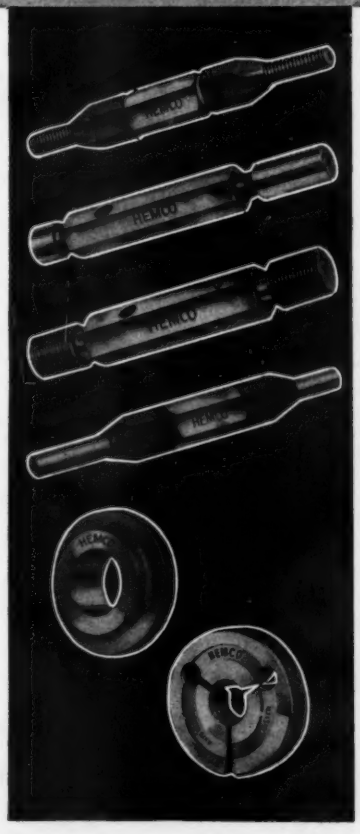

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Q-C? Prove It!

. . . or When You Think of Q-C, Think of Old Nell (Age 4 Mos.)

IT ALL BEGAN TO HAPPEN when I asked the boss to tell the bank that I'd be a good risk. He did, and I became the proud owner of one of Detroit's greatest . . . an engineer's engineering dream . . . full power, top-of-the-class engine, complete assortment of accessories, and an open-topped special, to boot. Yes, all mine . . . my spanking new '57 Forplychev!

As I said, that's how it started. Here, briefly, is what's happened since—

4 miles on the mileage indicator: Engine overheated; temperature gage registering in the danger zone. Check at nearest service station. No worry. Gage no good. Q-C?

150 miles: Gas tank still completely full (See, a real dream car). Oh-oh, gas gage no good, I realize as I wait for a push to a station. "What time did this happen?" you ask. "Can't tell — clock not working." Q-C?

500 miles: Two tires replaced, after running from car dealer to tire dealer to car dealer to tire dealer to prove that tires belong on the car. "Thumpers," they say. "Can't help it." Q-C?

1100 miles: . . . and on a trip, after a thorough check-up and soul-stirring testimonial from the dealer. "She's fit for a queen and a cross-country drive," he says, though he knows I just want to drive a few hundred miles.

1200 miles: Enroute; stop for gas — instinctively, 'cause still no gas gage. Suddenly, I'm in the midst of a Los Angeles-like smog . . . but 3000 miles from L. A. Half an hour later I watch as they drop Nell's innards to the ground, tie her drive shaft with a hunk of chain, yank her up, and drag her across 6" diameter "gravel" to the other side of the turnpike and to a garage.

"It'll be at least two or three days," they tell me there. "Our T. D. (Transmission Doctor) rides the circuit and won't be back this way again 'til then. Of course," the service manager adds helpfully, "it may be longer if he needs any special parts!"

So, I rub my then oil covered hands on my beige cashmere coat after closing the oil crusted back deck, take my suitcase in hand, and trudge off to find a bus to take me away from this engineer-forsaken country town to my destination. The car can rot, I thought then, but later my budget-minded conscience steered me back to pick up my Nell.

I think it's well to repeat one point: 1200 miles, transmission seal blown. Q-C?

They say time heals all wounds. I'm not so sure about that, tho. Old Nell (she sped through the transition from new to old in less than four months) registers 4128 miles now. Her top and rear window are permanently stained from the "accidental loosening of the transmission seal" at 1200 miles . . . her dashboard creaks without going over bumpy roads . . . her brakes squealled like a peanut vendor's whistling cart 'til they were re-lined . . . her remaining three original tires have been turned in . . . her gas pedal often coughs on the pick-up . . . her seats sag sans passengers . . . her clock ticks, its second hand swoops 'round the dial, but alas, it doesn't tell time. Q-C?

Maybe in the engineer's plan book in Detroit. But it too evidently wore out on the way through the production lines to the four-wheeled monster in my garage.

—*Carol E. Reuss*
Associate Editor

Coming Soon:

"The Transfer Press — an Automatic Factory"

"An Automated Line of Standard Machines"

"Broadening on Automatic Screw Machines"

"High PSI Coolant Inductor-Bushing Design"

Machine Measures To 0.00005" Direct At 10 Feet

The precise measurement of lengths and diameters beyond the size of the longest practical gage block has become an increasingly pressing problem. Machine tools, large turbines, and atomic reactors are a few of the units in which large components must fit precisely and interchangeably to insure their safe and efficient function.

The new Watts Length Measuring Machines provide a permanent and reliable universal standard to which gages and components can be set. Type A is available for 80" to 120" lengths. It consists of a measuring head which contains a 4" high precision glass scale with projector reading directly to 0.00005" and repeating to a setting accuracy of 0.00001". A high power microscope sets the measuring head to the master scale's 4" graduations. This scale is housed in a protecting channel at the center of the machine and below the work to be measured. The machine's bed contains optical compensators so that any graduation tolerance in the master scale can be fully compensated.

The Type B unit measures to 0.0001" at 30'. It employs a sectional bed and precision-divided steel master tape under constant tension. Otherwise it is similar in design to Type A.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, will send detailed information, or —
Circle Inform-A-Gram No. D3.

Necrology

Kenneth Hildenbrand, 59, chief inspector of the Monroe Auto Equipment Co. of Monroe, Mich., died of a cerebral hemorrhage in March.

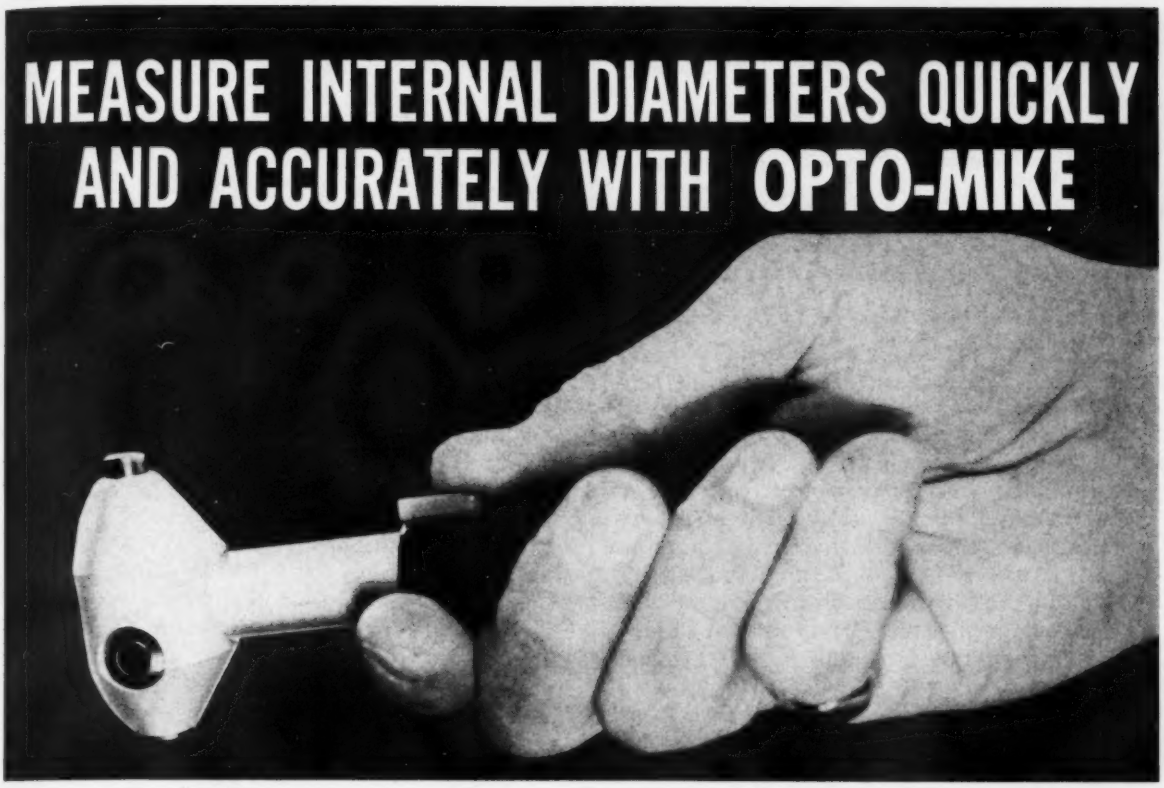
Henry Risko, sales manager of the Filtration Division of U. S. Hoffman Machinery Corp., died in his Syracuse, N. Y., home on March 6.

William LaCoste Neilson, vice president and former director of Norton Company, died Mar. 5 in New York City.

Stanley A. Odlum, 41, vice president of Atlas Corporation, died suddenly in New York on Mar. 15.

Ernest Mortensen, 64, president and general manager of Wesson Tool Company, Ferndale, Mich., until he recently retired, died suddenly on Mar. 22.

MEASURE INTERNAL DIAMETERS QUICKLY AND ACCURATELY WITH OPTO-MIKE



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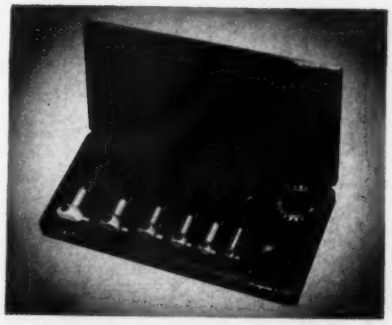
The **OPTO-MIKE** finds special value for determining elliptical or "out of round" condition. Based on the two-point measuring principle, the **OPTO-MIKE** can make two readings at right angles to one another, thus providing a precise measurement of "out of round."

OPTO-MIKE is now in daily use in many of America's largest industrial companies where **QUALITY CONTROL** is paramount. It has won approval and acceptance by Government Agencies.

Whenever bore dimensions must be checked, **OPTO-MIKE** is indispensable.



The OPTO-MIKE is available in matched sets for internal measurement from .800" to 6.000".

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Tighten Inventory Control by

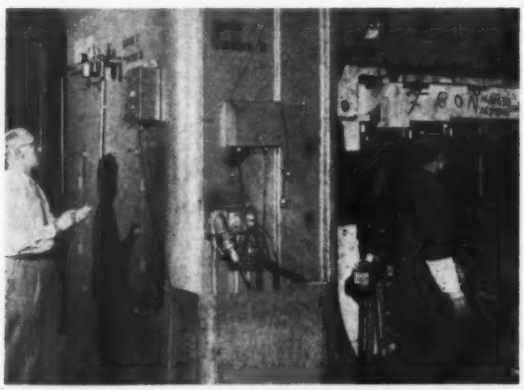
TRUE MEASUREMENT OF PRESS PRODUCTIVITY

SHRINKAGE OF IN-PROCESS INVENTORIES, from raw material to finished product, a problem common to nearly all manufacturing operations, has up until recently been almost impossible to control in stamping plants. On nearly every machine except a press, it has been relatively easy to obtain actual production counts. On presses, however, the standard cam- or switch-actuated register can produce counts from idle strokes as well as work strokes.

In many stamping plants, each press has a standard register which totalizes press strokes. At the end of any production period, the registers indicate what appears to be total parts produced. An attempt to correlate register readings with completed parts and scrap often shows excessive shrinkage in the production run.

Just recently, shrinkage in one plant was so great that it ran out of stampings several weeks earlier than anticipated. On the basis of register readings, the front office had assumed an adequate inventory for the balance of the schedule, and shut off production too soon.

Several devices, recently introduced by Control Devices, Inc., count actual press productivity. One of these, the Model L Load Counter, obtains a true count by differentiating between impact stresses caused by work strokes and impact stresses caused by idle strokes.



Load counter measures actual parts produced on this 900-ton Hamilton at Chrysler Corporation's Nine Mile Press Plant in Detroit.

A number of these units are now installed in automotive stamping plants. The counter employs a ceramic strain gage mounted on the side of the press. This generates a voltage pulse proportional in amplitude to the amount of impact stress in the frame. It is connected to a remote electronic counter, the sensitivity of which may be adjusted to reject small pulses caused by idle press strokes and count only large pulses caused by work strokes.

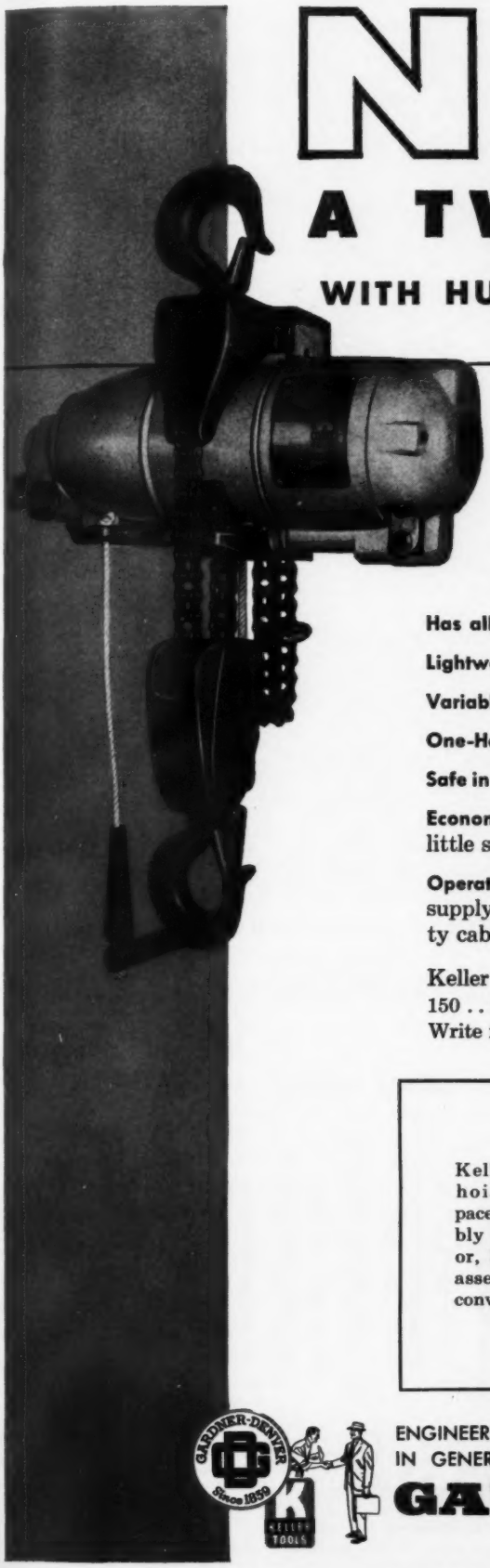
If the ratio between work-stroke stress and idle-stroke stress is 3:1 or greater, there is no chance of false counting. In fact, in one application, a deliberate but unsuccessful attempt was made to produce false counts by whacking the side of the press with a sledge hammer!

Where both production rates and parts costs are high, such as in automotive stamping or forging plants, plant managers are relying on such load counters for tighter inventory control. Chrysler Corporation's Nine Mile Press Plant in Detroit, for instance, is currently counting productivity on one press line with a load counter at either end. On this particular line, four 900-ton Hamiltons and a Danly are producing swept-wing quarter panels. Final trim is performed on a portable Clearing press. Counters are mounted on the first Hamilton and on the Clearing. Daily readings are made of these counters and correlated with actual finished part production figures for both quality control and inventory control.

Another typical installation utilizes two load counters on shears in a Buffalo forging plant. These shears are cutting 4" stock for crankshaft forgings. The counters enable tighter control; prior to their installation, it was difficult to account for any excessive amount of stock consumed.

Sometimes it is difficult to obtain true productivity count with the load counters because the work-stroke to idle-stroke stress ratio is

. . . *Continued on Page 124*



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New 2-ton hoist is powered by high-torque, axial-piston compressed air motor for positive starts and stops. A centrifugally governed, fully mechanical brake prevents slippage. Length of lift is 8 feet. Hook-to-hook dimension is only 23½ inches.

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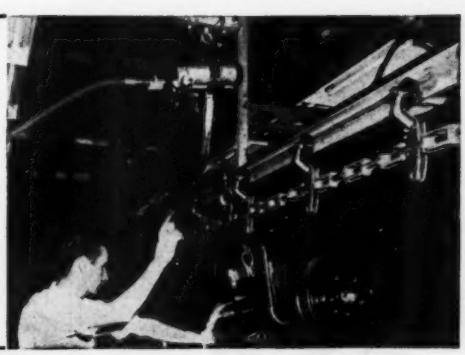
Operator Safety—powerful brake holds load regardless of air supply. An exclusive feature of the new two-ton hoist is a safety cable hole that provides extra safety for load and operator.

Keller Tool air hoists are available in lifting capacities of 150 . . . 300 . . . 500 . . . 1000 . . . 2000 . . . and *now* . . . 4000 pounds. Write for Bulletin 86.

Keller Tool air hoist, keeping pace with assembly line conveyor, lifts rear axle assemblies onto conveyor hooks.



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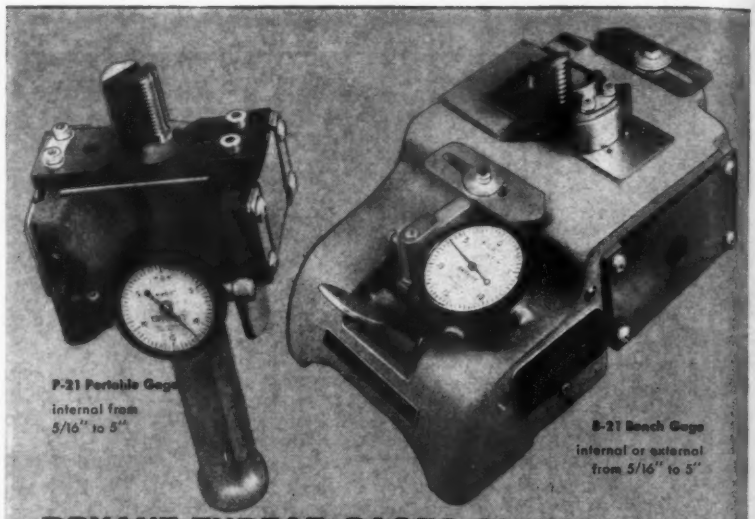

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- **WEARABILITY** 10 to 20 times longer life than conventional plugs and rings!
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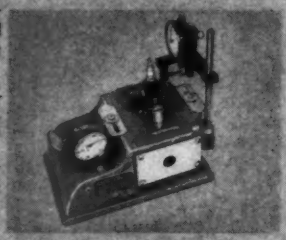
- **EASE of OPERATION** thumb lever collapses segments — rapid no wear loading.
- **VERSATILITY** Attachments for checking squareness of face, concentricity and other specialized applications.

WRITE FOR COMPLETE INFORMATION


Concentricity Attachment

Bryant Gage & Spindle Division
P. O. Box 620-F, SPRINGFIELD, VERMONT
Division of Bryant Chucking Grinder Company

CIRCLE INFORM-A-GRAM KEY NO. 1184

MAKE MONEY - - - SAVE MONEY
with WARDWELL'S Universal Automatic FLUTE GRINDER
Model 90FS

GRINDS TOOLS LIKE THIS FROM SOLID!

Make your own twist drills, spiral or straight reamers and end mills from solids on a production basis and save money.

Also avoid costly delays when special drills or reamers are required. Make drills as small as 1/16". Indexes automatically. No special skill needed.

WARDWELL
MANUFACTURING CO.
3809 Ridge Rd., Cleveland, O.

Descriptive Bulletin 90FS—Free

Maker of Largest Line of Saw and Tool Sharpening Machines

CIRCLE INFORM-A-GRAM KEY NO. 1185

now . . .

Carpenter e-x-t-e-n-d-s the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility found in no other oil-hardening, non-deforming tool steel, now assures extra cost-savings with Carpenter STENTOR (Oil-Hard). A broader, safe hardening range from 1425° F to 1525° F makes it possible to fit STENTOR tools and dies into many heat treating schedules during the average day.

Make your own evaluation. Add this extended built-in factor of safety to the other cost-saving advantages you get with STENTOR: easy machinability, less size change and distortion, uniform hardenability and freedom from decarb. Then call your local Carpenter Mill-Branch Warehouse, Office or Distributor for information and *rush delivery* on STENTOR with its extended built-in factor of safety.

Carpenter STEEL

matched tool and die steels

The Carpenter Steel Co., 106 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

CIRCLE INFORM-A-GRAM KEY NO. 119

YOU GET *SPEED* PLUS ACCURACY WITH MOORE JIG GRINDERS

HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¾ hours.*

CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

"HOLES, CONTOURS AND SURFACES

is bound to become a classic to the man or shop that does accurate work."

American Machinist Book Review

424 pages — $5 U.S.A., $6 elsewhere

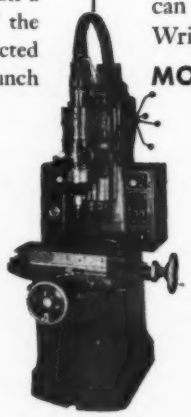
The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Ave., Bridgeport 7, Conn.



NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 120

Now semi-finish machined all over

to save your machining time and reduce waste

AMPCO METAL GRADE 18 CENTRIFUGALLY CAST STOCK BARS

Ampco Grade 18 Stock Bars are now labeled on one end, for convenience in stocking. Labels show I.D. and O.D. sizes to which bars finish.

14 New Sizes! Sizes now range from 1¼" to 8" I.D., 1¾" to 10" O.D. 12½" lengths.

Purchasing Simplified! Stated sizes are now the sizes to which bars will finish.

New Convenience! Finish allowance, 1/16" on the diameter, both O.D. and I.D. You need make only finish-machine cuts.

Same Dependability! Ampco Metal Grade 18 is a unique aluminum-bronze alloy that resists wear, withstands shock and impact, lasts many times longer than ordinary bronzes. Ideal for bearings, bushings, gears, other parts.

Stock the sizes you ordinarily use in maintenance and tooling — and get other sizes promptly from your nearby Ampco stocking distributor.

Write today for new stock list.

AMPCO METAL, INC.

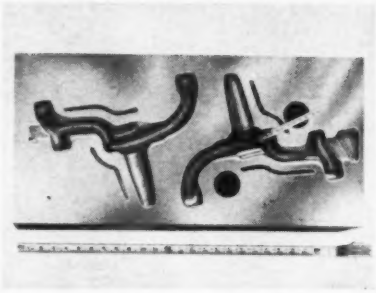
Dept. TP-5
Milwaukee 46, Wis.
West Coast Plant
Burbank, California

D-58

CIRCLE INFORM-A-GRAM KEY NO. 121

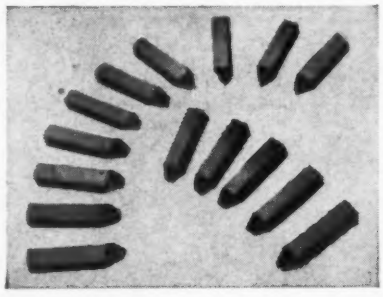
FORGING DIE INSERT

Material: Heppenstall 'A'
Conventional Machining Time: 76 hours
Elox Setup & Machining Time: 45 hours
Saved: 31 hours
Machine tool: Elox M-501 DieMatic
Electrode: Cast Elo-met
Customers report 50% saving on new forging dies and 75% savings in reworking dies.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

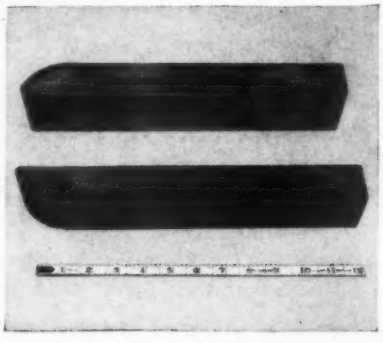
E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



EMBOSSING DIE

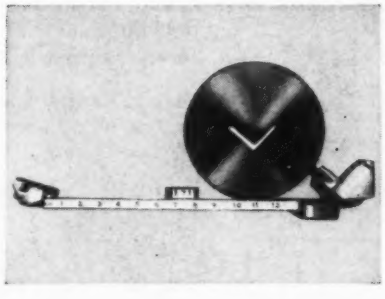
Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining Time: 227 hours
Elox Setup & Machining Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass



EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional Machining Time: 4 hours
Elox Setup & Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF EDM

. . . 4 jobs that prove Elox puts you ahead of competition

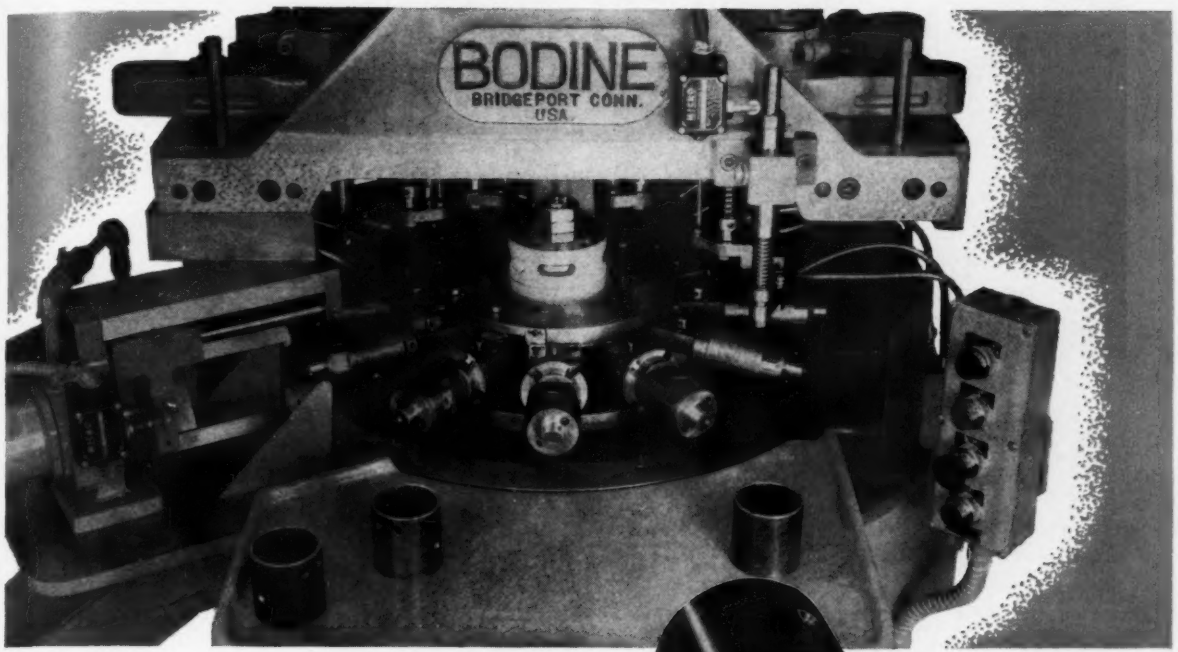
These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox corporation of michigan *T. M. Reg.

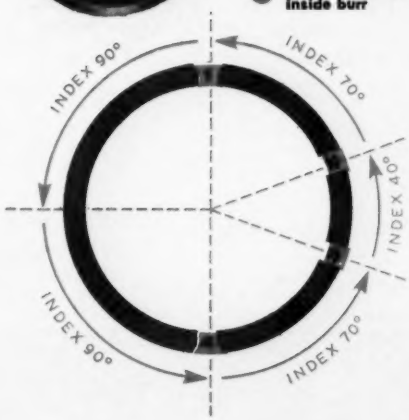
1834 N. Stephenson Highway
Royal Oak 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 122

Bodine case history no. 44



- Drill and countersink
- Drill
- Drill
- Drill and countersink
- Ejects stripping inside burr



here's how the automakers streamlined small motor production on BODINES

This Bodine Case History is really only one of many closely related installations in the key auto-electrical plants. The fact is that essentially ALL the small motors that power windshield wipers, window lifts, heaters, seat adjusters, etc., on today's cars are made this way . . . and on Bodine machines.

Parts being made on this 42-30 Bodine are tubular motor frames. On the production line, tube sections are conveyor-fed and held as shown on horizontal automatic indexing fixtures. After machining, they are automatically ejected by the stripper mechanism shown at the left of the machine, while special carbide inserts designed into the fixture remove inside burrs.

In the photograph above, auto-loading conveyor and locking mechanisms have been removed to show tooling.

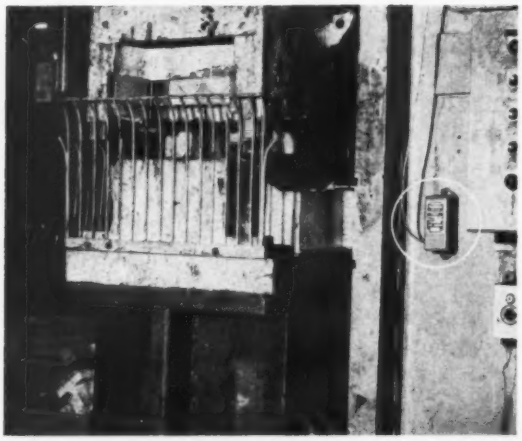
Simple, rugged Bodine VERTICAL tool spindles drill and countersink two holes and drill two additional holes through the walls of the tubing, as shown in the diagram . . . all accurate within close limits for position and angularity. The same machines can be quickly re-tooled for changes in motor sizes on yearly models. Similar Bodine machines (case histories on request) process the motor pole pieces, commutators, gear housings and end plates . . . Bodine speed and low-cost efficiency ALL the way.

PRODUCTION on this machine, with its specially designed electronic programming motor on the main drive to cut every second of idle time, is 675 pieces per 50-minute hour.

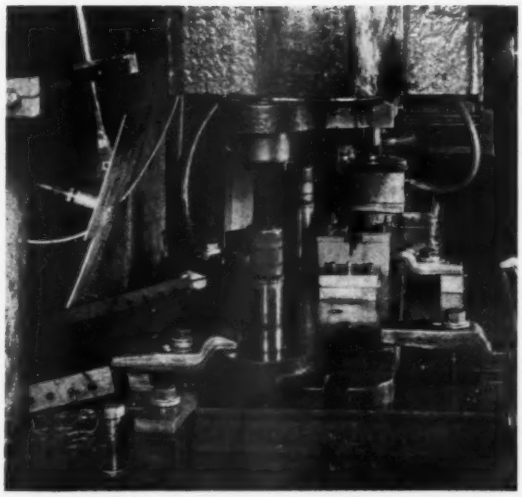
If you have a production job on which you, too, want to aim for an entirely new standard of cost-quality-volume efficiency, send drawings and samples to Bodine. Write Dept. TP-5.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

. . . Press Productivity from Page 116



Load counter receives count impulses from small strain gage mounted on press side. Pulse amplitude is much greater for work stroke than for idle stroke, thus idle stroke pulses can be distinguished and not counted.



Baffle on this press at Crawford Door, Detroit, mounts small pick-up for counting production with impact accelerometer. Each air-ejected part strikes baffle, causing pick-up to send count pulse to register unit.

not great enough. Such instances may occur when a press is utilized well below its rated capacity. Where this condition exists, another device, the Model K Impact Accelerometer, can be employed. Also manufactured by Control Devices, this consists of a sensitive pick-up, mounted on a baffle in the discharge chute. An ejected part hits the baffle and causes the pick-up to send a count pulse to a register. If the press is equipped with an electric clutch, the impact accelerometer can also serve as a press clearance control. A counting relay in the register unit is wired in series with the press control. A count pulse must be received to close the electric clutch circuit and permit press operation.

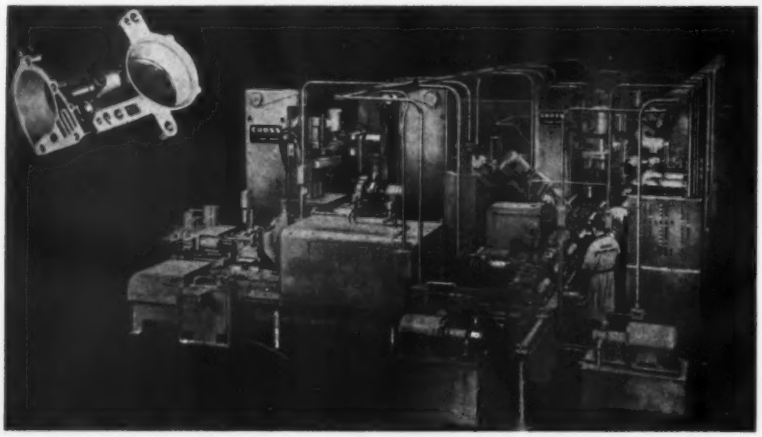
A Press Clearance Control, now undergoing final tests at Control Devices, features a variable high stress limit setting, adjusted to fit the requirements of each press or job. When that stress is exceeded, the press is automatically shut down.

With such devices as these, stamping supervision now has the means for more effective production control, lower inventory costs due to reduced safety cushions, and lower press maintenance costs.

end

TWENTY-FIVE STATION MACHINE PROCESSES SERVO VALVE BODIES

Completely machining servo-valve bodies for automatic transmissions, the most recently developed Transfer-matic machine produces 490 pcs/hr at 100% efficiency.



This new machine, built by The Cross Co., performs 21 drilling, 6 reaming, 5 tapping, 6 boring, and 2 precision facing operations.

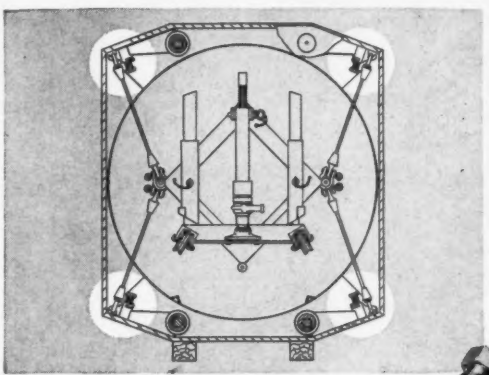
The parts travel through 25 stations — 1 loading, 9 drilling, 1 tapping, 2 rough boring, 2 precision boring, 2 precision facing, 1 washing, 6 visual inspection, and 1 unloading.

Palletized work holding fixtures each carry three parts. An unloading unit is provided for removing parts from fixtures and placing them on a conveyor.

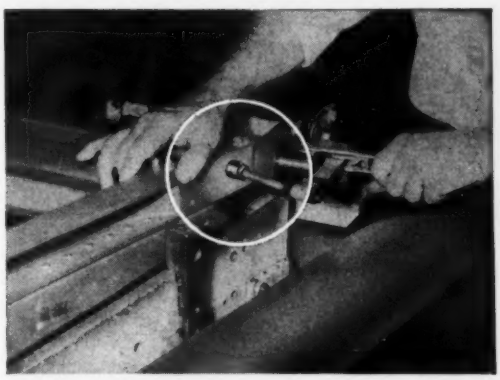
Design of the Transfer-matic incorporates complete interchangeability of all standard and special parts for easy maintenance, and Cross "building block" construction to provide flexibility for future changes in the design of the valve bodies.

TOOLING IDEAS your shop can use!

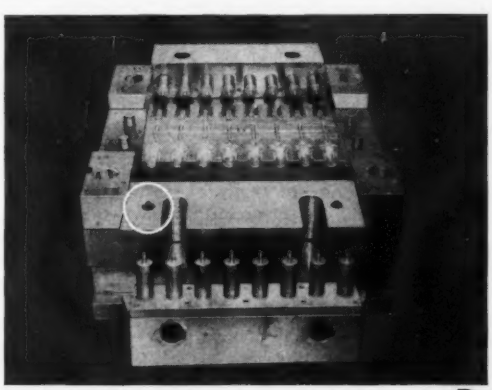
Shown below are just a few of the many uses for Vlier tooling accessories. Although these standard accessories are primarily used in jigs and fixtures, many companies are using them to replace custom-made devices in original equipment.



SPECIAL SWIVEL-PAD CLAMPS for a missile container manufacturer incorporate the remarkable Vlier ball-joint construction. Eight Swivel-Pad Clamps are used to release tension on cables which suspend the missile in its shipping container. This particular model withstands 21,000 load pounds.



CLAMPING PARTS WITH OFF-ANGLE SURFACES is no problem when Vlier Toggle Pads are used with a toggle clamp as shown here. The pad swivels 10° each side of the center line, assuring solid clamping of the part with no damage to the surface.

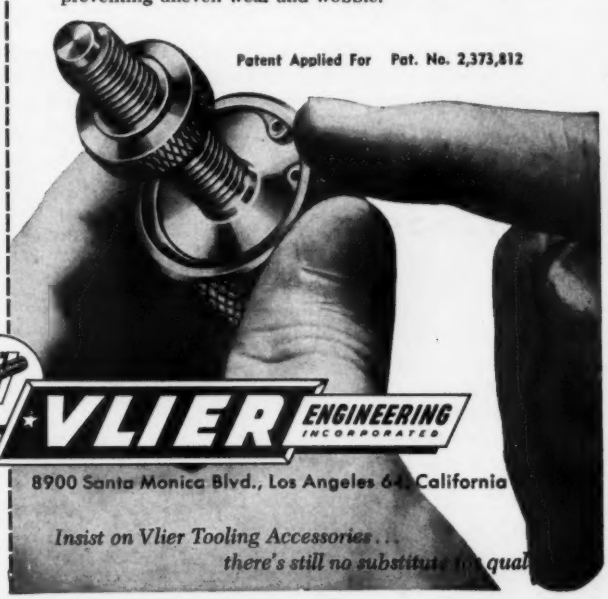


THIS 16-CAVITY, SIDE-ACTION PLASTIC MOLD uses four Vlier S-66 Spring Plungers as *detents* to lock the side-action bar in its travel to the center of the mold, eliminating costly, custom-made detents formerly used.

A glance at the new 1956 Vlier catalog will probably suggest many applications in your shop where you can standardize on Vlier accessories. Write for your free copy today.

New Head Design

on all Vlier Torque Thumb Screws protects working parts from dirt, chips, and other foreign matter. Truarc ring makes disassembly easy. In all Vlier Torque Thumb Screws the ball-check is perpendicular to the screw axis, preventing uneven wear and wobble.



VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 64, California

Insist on Vlier Tooling Accessories... there's still no substitute for qual

CIRCLE INFORM-A-GRAM KEY NO. 125

New data tells how

STUPALOX ***oxide cutting tools***
cut costs...
speed production!

Now at last! In a handy, well-organized booklet for easy reference—facts, figures and other technical data on the complete line of Stupalox oxide cutting tools and holders.

The amazing performance of these tools—developed by Stupakoff engineers—has established new highs in production and profits for users. They have brought about a new era in cutting tool performance. Faster speeds, deeper cuts, smoother finishes, and longer tool life add up to greater over-all economy. Even capital investment can be lowered, since production levels can be maintained with fewer machines and floor space released for other uses.

This new booklet contains all of this valuable information on one of the most exciting developments in the machine and tool industry during recent years. For your free copy, fill out and mail the coupon below.

STUPAKOFF DIVISION OF
The CARBORUNDUM Company

WRITE DEPT. TP 15 LATROBE, PENNSYLVANIA

SEND *for your FREE copy TODAY!*

Stupakoff Division of
The Carborundum Company
Latrobe, Pennsylvania

Please send me a free copy of Bulletin 257, STUPALOX OXIDE CUTTING TOOLS

NAME_____ TITLE_____

STREET_____

CITY_____ STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 126

TWO LARGEST TRIPLE ACTION PRESSES BUILT FOR FUTURE NEEDS

Anticipating the automobile of tomorrow, the Ford Motor Company is operating two triple-action presses—the largest ever built — in its Chicago Heights stamping plant. With bolster and blankholder dimensions of 200" x 100", they will handle body stampings as large as any likely to be specified in the design of future cars.

The presses, built by Hamilton Division of Baldwin - Lima - Hamilton Corporation, feature bottom-drive construction. This permits both upper slides to be pulled down by slightly stretchable rods allowing production of stampings of slightly varying thickness without blankholder adjustment.

The Hamiltons incorporate packaged design that has afforded a streamlined unit, with all controls — mechanical, electrical and pneumatic — designed integrally with the press and confined within the press framework. This allows quick and easy initial installation as well as maximum operator safety, plus ease of operation and maintenance.

Improper slide timing is prevented by mechanically synchronized actuation of all three slides from a single main drive. Air or electrical failure will not affect synchronization, and breaks in timing — easily possible in double-drive schemes — are impossible in the triple-action, Hamilton single-drive system.

Sequencing of the three actions consists of:—

1. 800-ton blankholder pulled down, holds blank.
2. 800-ton inner (upper) slide pulled down, makes a draw.
3. 550-ton lower slide pushed up, makes reverse form or blanking operation.

Speed of operation is 9 strokes/min. The main drive is a 250-hp motor.

The compact unit requires only 19' of head room and a 17' basement. Workmen shown in the illustration are standing at main floor level.

Why the Die Maker Prefers PRODUCTO Die Sets

Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

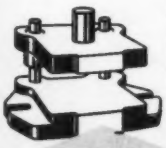
*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Ave., Bridgeport 1, Connecticut



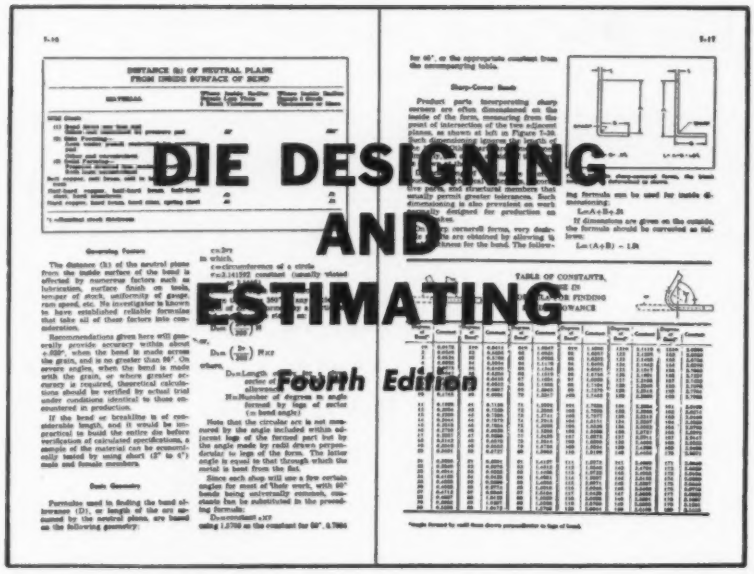
PRODUCTO

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

CIRCLE INFORM-A-GRAM KEY NO. 127



DIE DESIGNING AND ESTIMATING

Fourth Edition

Written expressly for–

- **Die Designers**
- **Die Engineers**
- **Tool & Die Makers**
- **Owners & Managers of Tool & Die Shops & Depts.**
- **Students**
- **Apprentices**

and . . .

368 pages, 26 chapters, over 400 illustrations, charts and graphs. Completely indexed.

USE THIS COUPON!

- **Valuable, too, as a reference and refresher for the die experts who are more than qualified to write a comparable text.**

A few of the major subjects covered:

Economical Use of Strip Stock
Step-by-Step Design of the Basic Dies
Short-Run, Lamination and Progressive Dies
Detailed Descriptions of Many Successful Dies
Effective Use of Inclinable Presses
Factors Affecting Perforator Life and Failure
Deep-Drawing Techniques
Blank Development
Time-Unit Values for Estimating Die Costs
Determining Required Press Capacity

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Immediate Shipment.

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DROODLES

by ROGER PRICE

Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"TOOTHPICK FOR NEW CAR OWNER"

When it comes to cars, we Prices are apt to lean more toward old-fashioned quantity than new-fangled quality. For instance, right now I've got a Moon sedan, a Rickenbacker phaeton, a Hupmobile roadster (with r.s.) and a Pierce-Arrow hearse. Not that I'm a connoisseur or anything . . . I just picked them up from time to time for a song ("Everything I have is Yours"). Anyhow, I keep my cars out in the back yard, and have loads of fun puttering around brushing the plush upholstery and hand-carving replacement parts. It's time well spent, because it keeps me out of the poolrooms, and who knows — some day I may get one of them to run.

Speaking of quantity, quality, parts, etc., reminds me of the Jones & Lamson Optical Comparator. This precision measuring and inspection instrument is being used more and more by all sorts of companies throughout industry. It measures a tremendous variety of objects and parts, speedily and accurately (to .0001"). It improves quality control, and its versatility makes it equally suitable for both production-line and small-lot work. In many instances, the J&L Comparator makes it possible to perform inspections that just aren't possible by any other method. Available in eleven bench and pedestal models. For complete details, write Dept. 710.

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

Precise, speedy inspection of parts at every stage of manufacture

J & L Optical Comparators are ideal for production line inspection work. They check parts — even intricate ones — with remarkable speed and accuracy, and instantly reveal any errors in manufacturing operations. Investigate how J&L Comparators can help increase production and cut scrap volume in *your* plant.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U. S. A.

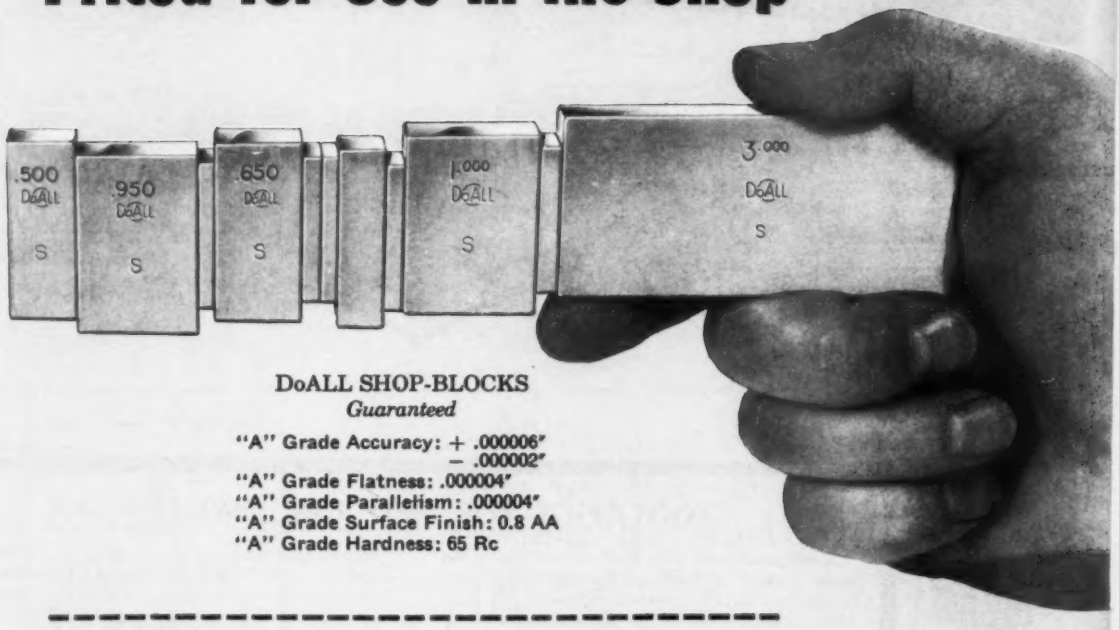
Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

CIRCLE INFORM-A-GRAM KEY NO. 129

New "A" Grade Gage Blocks Priced for Use in the Shop



DoALL SHOP-BLOCKS
Guaranteed

"A" Grade Accuracy: + .000006"
− .000002"
"A" Grade Flatness: .000004"
"A" Grade Parallelism: .000004"
"A" Grade Surface Finish: 0.8 AA
"A" Grade Hardness: 65 Rc

SET NO. 860
84 pieces*
Only $265

.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—49 Blocks .101" thru .149"
.050" Series—19 Blocks .050" thru .950"
1.000" Series—4 Blocks 1.000" thru 4.000"
Quarter tenth Series—3 Blocks .100025", .100050", .100075"

SET NO. 380
36 pieces*
Only $130

.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—9 Blocks .101" thru .109"
.010" Series—9 Blocks .110" thru .190"
.100" Series—5 Blocks .100" thru .500"
1.000" Series—3 Blocks 1.000", 2.000", 4.000"
Half tenth Series—1 Block .10005"

Now you can bring totally new accuracies to shop measurements with DoALL SHOP-BLOCKS . . . *guaranteed* "A" grade, yet available at "B" grade "working" block prices.

These blocks are available from stock today. Call your local DoALL Store, or write.

**.050" or .100" steel or carbide wear blocks available at slight extra cost.*

Catalog free on request—send for your copy today.

THE DoALL COMPANY • Des Plaines, Illinois

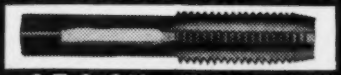
DoALL

G8-24

CIRCLE INFORM-A-GRAM KEY NO. 130

— SAVE THIS AD FOR FUTURE REQUIREMENTS — DEALERS INQUIRIES INVITED

WHY WAIT for SPECIAL High Speed Steel TAPS and DIES?



IN STOCK FOR IMMEDIATE DELIVERY!

New sizes added daily • • • If not listed hereon inquire

Size	Threads Per Inch
00	90-96
0	56-64-72
1	56
2	60-72
3	40-60-64
4	32-42-44-56-60-64
5	30-32-36-48-56-80
6	30-36-38-42-44-48-56-60-64
7	28-30-32-34-36-38-40
8	24-26-30-38-40-44-48-56-60-64-80
9	24-28-30-32-40
10	18-20-22 26 2[illegible]-30 36-40-43-56-64
11	20-22-24-28-30
12	20-22-26-27-30-32-36-38-40 48-56
13	20-22-24-32
14	16-18-26-28-30-32
15	18-20-24
16	16-18-20-22-24
17	16-20
18	16-18-20-24
19	18-20
20	16-18-20-24-32
22	16
24	14-16-18-22-24
26	14-16
28	14-16
30	14-16
1/16	56-60-64-72
5/64	56-60-64-72
3/32	38-48-50-56-60-64
.107	32
7/64	36-40-42-44-48-50-56
1/8	32-36-40-48
.132	50
9/64	30-32-38-40
5/32	24-26-28-30-32-36-38-40
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-28-30-32-36-40
.198	24

RIGHT HAND TAPS

Size	Threads Per Inch
13/64	24-28-30-32
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-24-28-32-40
1/4	16-18-22-23-24-25-26-27-30-32-36-40-50-56-60
17/64	18-20-27-28
.269	36
.277	40
9/32	18-20-24-27-28-32-36-40
19/64	18-24
.300	28
5/16	12-14-16-20-22-26-27-28-30-32-36-40-48-50-56
21/64	16-20-24
11/32	16-18-20-22-24-26-27-32-40
23/64	16-24
.365	28
3/8	12-14-18-20-22-26-27-28-30-32-36-40-48-56
25/64	16-24-27
.400	24
13/32	12-14-16-18-20-24-27-32-40
27/64	28
7/16	12-16-18-22-24-26-27-28-30-32-36-40
29/64	12
15/32	12-14-20-24-27-28-32-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
33/64	12-13-20
17/32	10-12-13-14-16-18-20-27-32-40
.550	24
9/16	13-14-16-20-24-27-28-30-32-40-48
37/64	12-27
19/32	12-18-20-24
5/8	9-10-12-13-14-16-20-24-27-28-32-36-40
41/64	11-18-24
21/32	10-11-18-20-27-32-40
11/16	20-.004
11/16	24-.010
11/16	11-12-14-16-18-20-24-27-28-30-32-36-40
23/32	11-16-20-27-32-36-40
47/64	10-16
3/4	9-11-12-14-15-18-20-22-24-26-27-28-32-36-40
49/64	10-16
25/32	10-16-20-27-32-40
.800	16
13/16	10-12-14-16-18-20-24-27-28-32-40
.822	8
27/32	10-18-20-27-32-40
7/8	8-10-11-12-13-16-18-20-24-26-27-28-32-36-40
.885	14
29/32	12-20-27-28
15/16	8-9-10-12-14-16-18-20-24-27-28-32-40
31/32	9-16-20-28-32
1	5-9-10-11-12-16-18-20-24-27-28-30-32-40-48
1-1/32	8-12-14
1-1/16	8-10-12-14-16-18-20-24-27-28-32
1-3/32	8-9-12
1-3/64	14
1-1/8	8-10-14-16-18-20-24-27-32
1-5/32	7-12-24-26-40
1-3/16	8-10-12-14-16-18-20-24-32
1.220	32
1-1/4	8-10-14-16-18-20-24-28-32
1-5/16	6-8-10-12-14-16-18-20-24-32-48
1-3/8	8-10-14-16-18-20-24-32
1-13/32	20
1-7/16	6-8-10-12-14-16-18-20-24-28-32
1-1/2	8-10-13-14-16-18-20-24-28-32
1-17/32	18
1-9/16	12-14-16-18-20-24-32
1-5/8	5½-8-10-12-13-14-16-18-20-24-28-32-40
1-11/16	10-12-14-16-18-20-24-32
1-3/4	5-8-10-12-13-14-16-18-20-24-28-32-40
1.7715	12
1.767	18
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20 24-32
2-1/16	12-14-16-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	12-16-20
2-1/4	4½-8-10-12-14-16-18-20
2-5/16	12-16-18-20
2.360	18
2-3/8	4-8-10-12-14-16-18-20
2-7/16	16-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	12-18
2-5/8	8-10-12-14-16-20
2-11/16	16
2-3/4	4-8-10-12-14-16
2-7/8	8-10-12-16
2-15/16	16
3	3½-4-8-10-12-16-18
3-1/8	12-16
3-1/4	4-8-12-14-16-18
3-1/2	4-8-12-16
3-3/4	4-8-12-16
4	4-8-12
4-1/8	12

Size	Threads Per Inch
0	80
1	56-64-72
2	56-64
3	48-56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-32-40
12	24-28-32-40
14	20-24
5/32	36
3/16	32-40
1/4	20-23-24-25-27-28-32-40-48
.277	40

LEFT HAND TAPS

Size	Threads Per Inch
5/16	18-20-24-27-28-32-40
11/32	24
3/8	16-20-24-27-32-40
13/32	20
7/16	14-20-24-27-28-32-40
1/2	12-13-14-16-20-24-27-28-32-40
9/16	12-18-20-24-27-32-40
.622	8
5/8	10-11-12-16-18-20-24-28-32
11/16	11-16-18-20-24-32
.720	8
.722	8
3/4	9-10-12-16-18-20-24-32
13/16	10-16-18-20
7/8	9-10-12-14-16-18-20-24-32
15/16	32
1	8-12-14-16-18-20-24-28-32
1-1/8	7-12-18-24-32
1-1/4	6-7-8-12-16-18-20
1-5/16	18
1-3/8	5-6-8-10-12-16-18-20-24
1-7/16	10-12-18
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	5½-8-10-12-16-18-20
1-11/16	8-10-12-16-18-20-24
1-3/4	5-8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	5-8-10-12-14-16-18-20
2	4½-8-10-12
2.215	20
2-7/32	20
2-¼	4½-8-12
2-5/16	24
2-½	4-8-12
2-11/16	16
2-3/4	4
2-7/8	24
3	4-8

RIGHT HAND—UNLISTED "GUN" OR SPIRAL POINTED TAPS

Size	Threads per Inch	Size	Threads per Inch
0	80 NF		
1	56 NS	⅞	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 14 NF
9/16	12 NC, 18 NF	1⅛	7 NC, 12 NF
⅝	11 NC, 18 NF	1¼	7 NC, 12 NF
11/16	11 NC, 16 NF	1⅜	6 NC, 12 NF
¾	10 NC, 16 NF	1½	6 NC, 12 NF

RIGHT HAND—UNLISTED "PULLEY" OR EXTRA LENGTH TAPS

Size	Threads per Inch	Size	Threads per Inch
4	40 NC, 48 NF	⅜	24 NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	½	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	⅝	18 NF
	28 NF	¾	16 NF
5/16	24 NF	Also Larger Sizes NC & NF	

RIGHT HAND "PIPE" TAPS

TAPER "NPT" Size	TAPER "NPT" Thread	STRAIGHT "NPS" Size	STRAIGHT "NPS" Thread	EX. LENGTHS TAPER "NPT" Size	EX. LENGTHS TAPER "NPT" Thread
1/16	27	1/16	27	1/16	27
¼	27	1¼	11½	⅛	27
2½	8	1½	11½	¼	18
3	8	2	11½	⅜	18
3½	8	2½	8	½	14
4	8	3	8	¾	14
		3½	8	1	11½
		4	8		

LEFT HAND 'PIPE TAPS' TAPER AND STRAIGHT

Size	Thread	Size	Thread
1/16	27	1	11½
⅛	27	1¼	11½
¼	18	1½	11½
⅜	18	2	11½
½	14	2½	8
¾	14	3	8

"OVERSIZE TAPS"

RIGHT HAND N. C. and N. F. SIZES

MACHINE SCREW No. 2 TO No. 5 PLUS .002 TO .003

MACHINE SCREW No. 6 TO No. 14 PLUS .003 TO .005

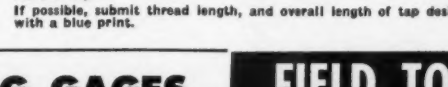
FRACTIONAL ¼" TO 1½" PLUS .003 TO .005 AND .010

"UNDERSIZE ALSO AVAILABLE"

"PRICES OF SPECIALS ARE GOVERNED BY QUANTITY ORDERED" PRICES QUOTED UPON REQUEST

REGULAR LISTED SIZE TAPS AND TOOLS IN STOCK FOR IMMEDIATE DELIVERY

ACME TAPS AVAILABLE FOR QUICK DELIVERY

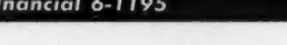


2 WEEKS DELIVERY—When ordering or requesting quotations, kindly furnish us with the following information:

(a) Kind of material being machined.
(b) Depth of hole, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machine stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with a blue print.

SPECIAL REAMERS IMMEDIATE DELIVERY

H.S.S.S. MACHINE REAMERS DECIMAL, FRACTIONAL, LETTER, AND WIRE GAUGE SIZES
Prices On Application
Write for Our Stock List



SPECIAL — RIGHT HAND HIGH SPEED "EXTRA LENGTH DRILLS" In Stock for Immediate Delivery

WE ARE WELL EQUIPPED TO SUPPLY YOUR NEEDS IN ANY QUANTITY, PARTICULARLY WHEN YOU ARE IN A HURRY

PLUG AND RING GAGES

STANDARD AND SPECIAL

2 WEEKS DELIVERY PRICES ON APPLICATION

FIELD TOOL SUPPLY CO.

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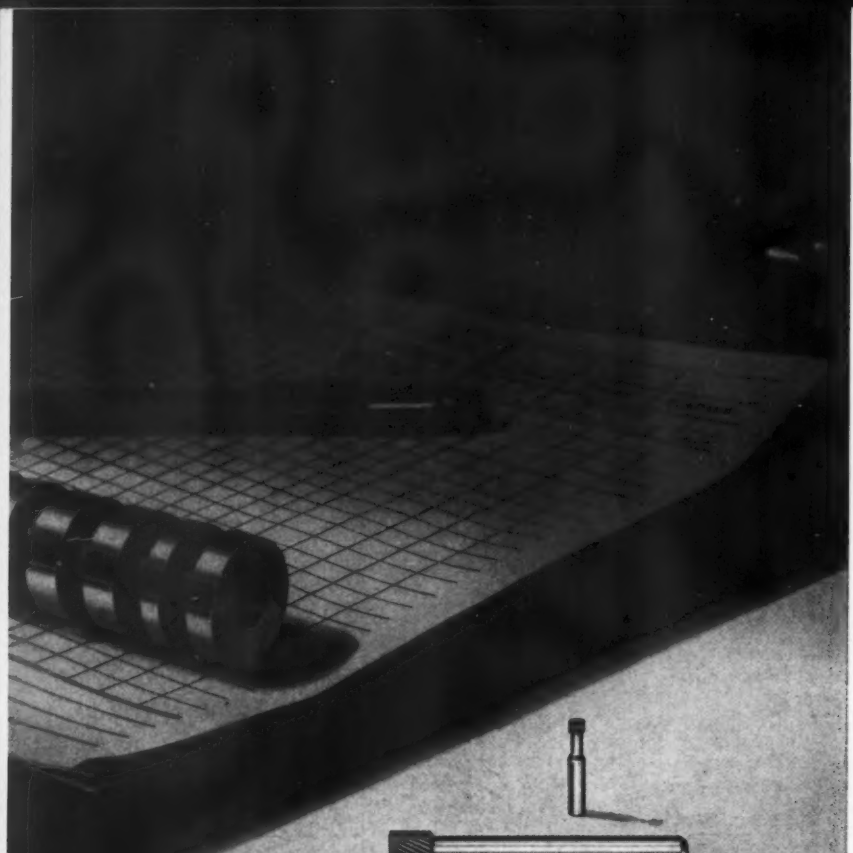
CIRCLE INFORM-A-GRAM KEY NO. 131



Figures Prove
They Last 3 Times Longer!

When it comes to finishing small holes — down to .032" diameter — P&W Kellerflex Carbide Hole Finishing Burs have proved on job after job that they will consistently *outlast and outperform* all other finishing methods and competitive burs. On one recent job, P&W Burs lasted more than 3 times longer than the next best. On another, they delivered up to 5000 pieces per bur. In addition, P&W Burs speed up production . . . machining time is as little as 30 seconds per piece. Accuracy and finish are improved . . . work has consistently been held to .0002" for size, .00005" for roundness, and 4 micro-inches for finish! The fast-growing miniaturization market can mean BIG profits from small parts, and P&W Carbide Burs finishing small holes can help you get your share.

Write now for complete information.
Pratt & Whitney Company, Incorporated
15 Charter Oak Boulevard, West Hartford, Conn.

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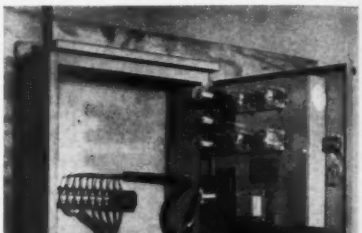
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES • CUTTING TOOLS
CIRCLE INFORM-A-GRAM KEY NO. 132

ELECTRONIC CONTROL PROVIDES ADJUSTMENTS TO PRESS UNLOADERS

A new electronic remote control system for adjusting automatic press unloaders in the automotive and appliance industries has been designed for use with existing and new Sahlin Iron Hand installations.

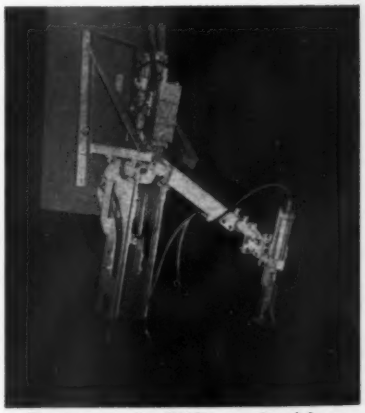
The unit, developed by Sahlin Engineering Company, Inc., is adaptable to all Sahlin automatic unloading machines including the overhead arm Iron Hand, portable unloader, transfer machines, and other allied automation machinery.

With the new unit, operators can adjust unloaders by merely turning calibrated dials. Nine different adjustments are possible including main cylinder speed control, delay between jaw gripping panel and lifting action, jaw release point, arm stroke and over-travel, arm return-



"Heart" of the control; the relays and timer tubes are "plug in" type for fast servicing and easy replacement of individual components. In addition, the entire unit is a plug-in package and can be removed and replaced in less than a minute if necessary.

stroke delay, independent arm or jaw operation, and Iron Hand cycling independent of the press. Time



Test setup of a Sahlin overhead Iron Hand equipped with the new electronic remote control system. The new control unit makes possible nine different instantaneous adjustments, all from floor level and all possible while the Iron Hand is operating.

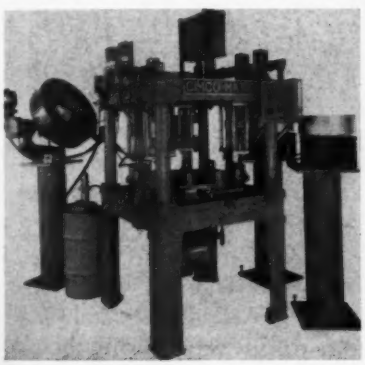
delay increments from 0 to 6 sec are provided.

The Iron Hand responds instantly to these settings, or changes in settings, thereby speeding up adjustments which may be required during production, and saving time on die changeover; in addition, all adjustments can be performed while the Iron Hand is operating. Finally, a "memory" chart is provided to record dial settings for individual die setups, a design feature that eliminates guesswork and further speeds changeovers.

STANDARD COMPONENTS MAKE UP SPECIAL ASSEMBLY MACHINE

Open, simplified design, permitting ready accessibility for operation and retooling, is featured in a new line of special assembly machines.

The Cimco Special, manufactured by Cimco Engineering Company, has 12 stations and was developed for assembling upper horn bearing assemblies for a 1957 model car. The machine has a Cimco 12-station index table with a special 36" dial plate; pneumatic operated work stations; and an electrical control system designed to JIC Standards. The machine is producing 900 complete assemblies/hr with one operator.



All work stations are designed around standard tooling support units suspended from the top plate, which readily permits machine modification for minor part changes. These special-purpose assembly machines are built up from standard components.

The index tables are electric motor driven through variable speed pulleys with a Geneva motion and are electrically interlocked with the machine so that the work stations are operative only when the locking shot-pin is fully engaged. This safety interlock controls the machine on hand as well as on semi- or fully-automatic operation.

He's doing the job
FASTER and CLEANER

...BECAUSE P&W KELLERFLEX® BURS are MASTER MACHINE GROUND

Precision in every respect, they cut faster and smoother without chatter or bounce and deliver an overall performance efficiency that *no* hand ground bur can possibly match. All P&W Burs of the same size and shape are exact *duplicates* . . . have *identical* cutting characteristics. And you can select the *right* bur for all your jobs from the complete P&W Kellerflex line that includes: high speed steel or solid carbide types, 3 basic cuts, 4 shank sizes, 6 types of master ground fluting and 18 standard shapes (plus hundreds of specials). Available from stock at the P&W Branch Office near you.

Write now for complete information.
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CIRCLE INFORM-A-GRAM KEY NO. 133

Bay State mounted wheels are used by Lycoming craftsman, Fred McCall, on hardened steel drive component to "break" sharp edges which might cause points of weakness.

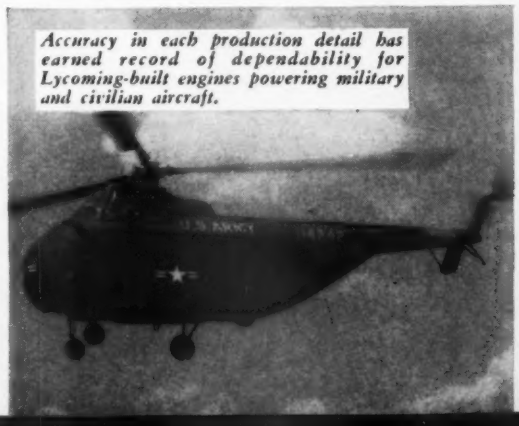
Grinding at Lycoming Needs Wide Range of Wheels — Versatile Engineering

TO the Lycoming Division of Avco Manufacturing Corporation at Stratford, Connecticut, *dependability* in aircraft engines is as important a product as the engines themselves! And precision grinding, in many forms, helps produce this built-in dependability.

For example skilled deburring of the accessory drive gear component shown on this page is important because sharp edges could set up points of weakness . . . and human life will be at stake.

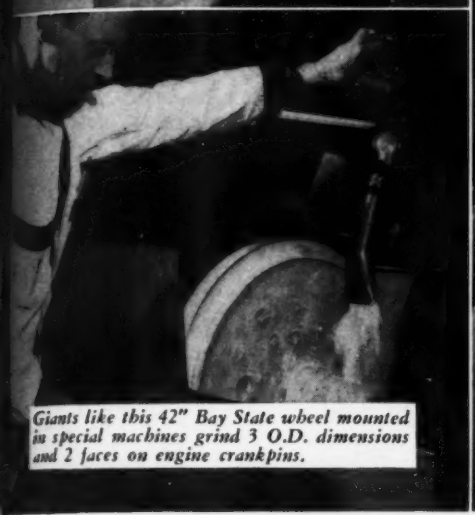
On these carburized steel parts with surface hardness to Rockwell C, a small spherical wheel of exceptional durability is needed to do the job neatly and precisely. A wheel too soft grooves quickly and leaves a ragged edge, needing another operation to finish it. Bay State specified, and manufactures for this job, a wheel that skillfully combines the necessary hardness with a clean cutting action which leaves no surface burn — also important because all parts must pass 100% acid-etch inspection.

Specifying and faithfully reproducing these efficient small wheels is one important Bay State contribution to the dependability of Lycoming-built engines.

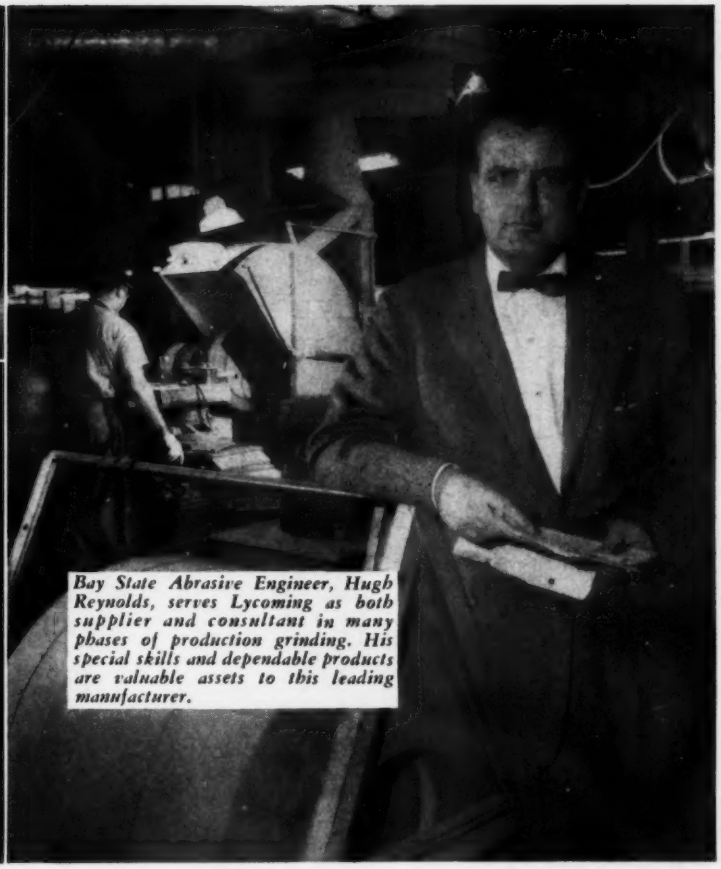


Accuracy in each production detail has earned record of dependability for Lycoming-built engines powering military and civilian aircraft.

Precision ground parts must meet the most rigid Lycoming standards of surface finish as well as dimensional accuracy.



Giants like this 42" Bay State wheel mounted in special machines grind 3 O.D. dimensions and 2 faces on engine crankpins.



Bay State Abrasive Engineer, Hugh Reynolds, serves Lycoming as both supplier and consultant in many phases of production grinding. His special skills and dependable products are valuable assets to this leading manufacturer.

In the larger grinding wheel sizes, too, Lycoming depends on Bay State for many critical operations. The multi-purpose cylindrical grinding set-up illustrated above is a typical case.

This special Landis grinder mounts a mammoth wheel, 42" x 6" x 12", specified by Bay State to perform a series of precision grinding operations on engine crank-pins. Three different O.D.'s and two faces are ground on this critical component, removing from .015 to .050 stock. The part made of AMS-6415 nitriding steel is finish ground in the soft state at about 35 Rockwell C. The successful Bay State specification was selected for its ability to produce fine, uniform finish, yet hold its corners for long productive periods between dressings.

At Lycoming and other plants, Bay State engineers are solving grinding problems . . . applying grinding wheels from the smallest to the largest . . . specifying grinding wheels for every purpose, every type of machine.

With confidence, call in Bay State through any of its branch offices or distributors.

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Mass., U. S. A.
Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
Distributors — All principal cities • In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

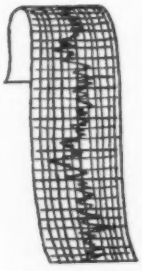
BAY STATE ® WHEELS of PROGRESS

CIRCLE INFORM-A-GRAM KEY NO. 135

for surfaces that have defied measurement

THE **TALYSURF**

the practical master instrument to check surface finish



Diamond stylus of .0001" standard tip faithfully registers *all* scratches. It is power traversed under a pressure of only .1 gram (.0035 oz.) — important for all surfaces; a "must" for soft materials.

Produces true inkless straight-line graph tracing actual profile of surface irregularities through electrically interlocked and precisely repeating mechanism.

After a single stylus traverse, the integrating meter indicates an average to American Standard ASA B46.1-1955. There is no wavering of the pointer—it remains electrically locked at the correct average reading.

The Talysurf is your key to manufacturing and inspection methods for reject-free automatic production of parts requiring highest surface accuracy.

Complete information will be furnished without obligation — write Dept. ST-57

ENGIS EQUIPMENT COMPANY
431 S. DEARBORN STREET CHICAGO 5, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1361

CARBORUNDUM SETS UP MAIL ORDER CLINIC FOR ABRASIVES USERS

"Maximum Automation Potential" is Carborundum Company's new type abrasive and abrasive belt machine engineering service which gives recommendations by mail for improving metal removal methods and predicts savings over old methods. So far it has a 90% accurate batting average, according to John Claydon, general manager of the company's Coated Abrasives Division.

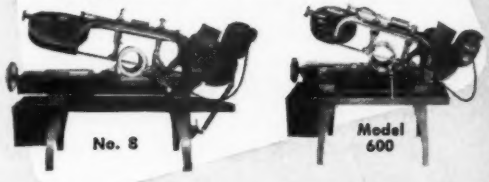
The first of its kind in industry, reports Mr. Claydon, the M.A.P. is the cumulative result of several years' effort to help manufacturers move in the direction of greater mechanization and automation of stock removal. Traditionally, abrasive engineers have made individual in-plant studies and recommendations. In doing so they have accumulated thousands of case studies which have been filed by Carborundum. The Maximum Automation Potential engineering service has been developed to get the benefit of these studies into the hands of manufacturers without in-plant visits.

All types of coated abrasive information have been broken down into classifications of customer application problems, factors common to all of the classified types have been isolated, and variables have been isolated and resolved into their least common denominators. This data has been reduced by categories into scientific formulae which can be applied to manufacturers' problems in the respective categories.

The system was tested both in laboratory setups simulating customer problems and in the field.

In operation, the M.A.P. system works this way: The manufacturer writes to the M.A.P. Department, The Carborundum Company, Niagara Falls, N. Y.

Simple Design... Rugged Construction



WELLS HORIZONTAL METAL CUTTING BAND SAWS

The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low. See your Wells Distributor.

Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
1940 Cedar Street Three Rivers, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1362

By return mail an M.A.P. brochure is sent to him. He details his problem in the form enclosed in the brochure and mails it back. Then, at Carborundum, specially trained engineers study the manufacturer's problem, formulate an item-by-item recommendation, compare costs of the recommended new method with the method currently used, and project increased production and savings. This M.A.P. recommendation is promptly mailed back to the manufacturer for his consideration.

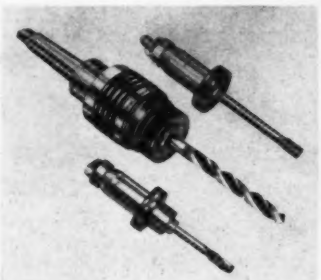
With this service, says Mr. Claydon, Carborundum offers assistance to manufacturers on how to mechanize and automate their abrasive operations as far as possible and practical for them under the specific conditions presented in their confidential inquiry. The economics of each recommendation, he adds, is based on tested data that takes the guess-work out of the manufacturer's planned conversion to improved metal removal methods.

HASSNER
QUICK CHANGE PRECISION CHUCKS

WHAT DO THEY OFFER YOU?

a. Superiority in PRECISION.
b. Tool Change can be made with spindle rotating up to 7,000 RPM.
c. Shifting and slipping impossible; no chewed up tools.

Sole U.S.A. Representative

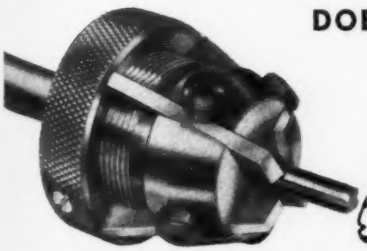


ALL THIS MEANS BETTER WORK AND TIME SAVING, THUS INCREASED PROFITS

NEISE MODERN TOOLS **KARL A. NEISE** 404 4th Ave., Dept. TP New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1371

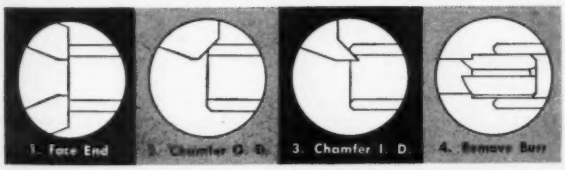
TUBE DEBURRING TOOL
DOES 4 JOBS AT ONCE



ROUGH END . . .

BRASS • COPPER
STEEL • ALUMINUM

. . . TO FINISHED END



- Replaceable cutters
- Replaceable pilot reamers
- Adjustable for size control
- Easily reground in your plant

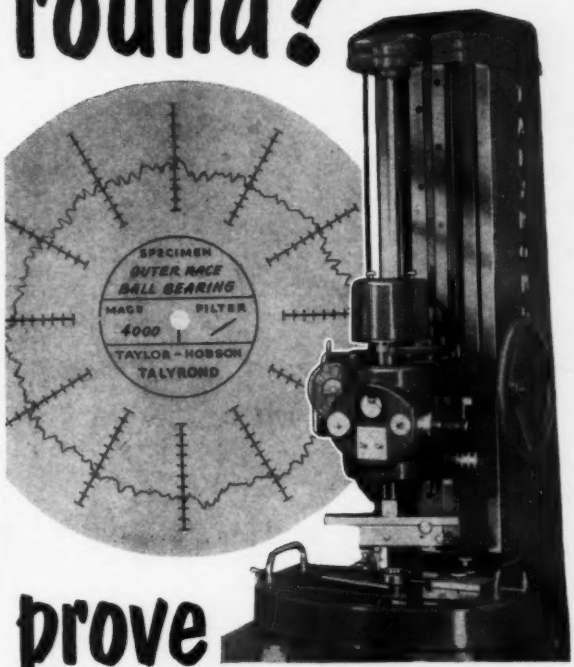
Standard sizes for 3/16" to 1-1/4" tubing.

Write for Bulletin 46P

GENESEE MANUFACTURING COMPANY
566 HOLLENBECK ST. • ROCHESTER 21, N. Y.
Adjustable Hollow Mills - Facing and Counterboring Tools - Special Production Tools
Tube Deburring Tools - Since 1908

CIRCLE INFORM-A-GRAM KEY NO. 1372

is it really round?



prove it with the . . . TALYROND

This electronic master instrument measures and records roundness and concentricity on all units of circular cross section.

The Talyrond graphs all deviations from true roundness on balls, rollers, bearing races, valves, gages. Its stylus, carried on an ultra-precision spindle, fully sweeps the part to be checked and provides a permanent inkless record, with radial magnification of 50 to 10,000.

The Talyrond record is your basis for analysis of manufacturing and inspection methods required to maintain reject-free automatic production of circular parts of the highest accuracy.

For complete information without obligation, write Dept. ST-557

ENGIS EQUIPMENT COMPANY
431 S. DEARBORN STREET CHICAGO 5, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1373

Production Lapping and Polishing of Parts

SYNTRON Lapping Machine lapping shaft seal components to precision flatness.

SYNTRON
Vibratory

LAPPING MACHINES

SYNTRON Lapping Machines save many man hours, and cut production costs by producing metallographic finishes, precision flat surfaces on component parts in production quantities. Their gentle vibration with variable speed control assures a positive polishing action on parts or samples where metallographic finishes are required. Investigate how Syntron Lapping machines can cut your production costs. Easily installed — no expensive grinding equipment necessary. Low cost, dependable operation.

Builders of quality equipment for more than a Quarter-Century.

Other Syntron Equipment of Proven Dependable Quality

BIN VIBRATORS

ELECTRIC HAMMERS

SHAFT SEALS

Write for Syntron Complete Equipment Catalog — FREE

SYNTRON COMPANY
341 Lexington Avenue Homer City, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 138

TWO WAY MACHINE SPEEDS UP UNIVERSAL JOINT PRODUCTION

Production of yokes for automotive universal joints has been increased appreciably by the installation of an Ex-Cell-O two-way boring machine in the plant of an automotive parts supplier. This machine is maintaining a fast production schedule by permitting simultaneous operations at both ends of the part.

Made of malleable iron, the universal joint yokes are fixture-clamped and two holes are finish bored in line. A three-station, hydraulically operated fixture and three boring spindles on each slide of the machine produce three machined yokes in each automatic cycle.

PLASTISOL LINED SAND BLAST BARRELS LAST TWELVE TIMES LONGER

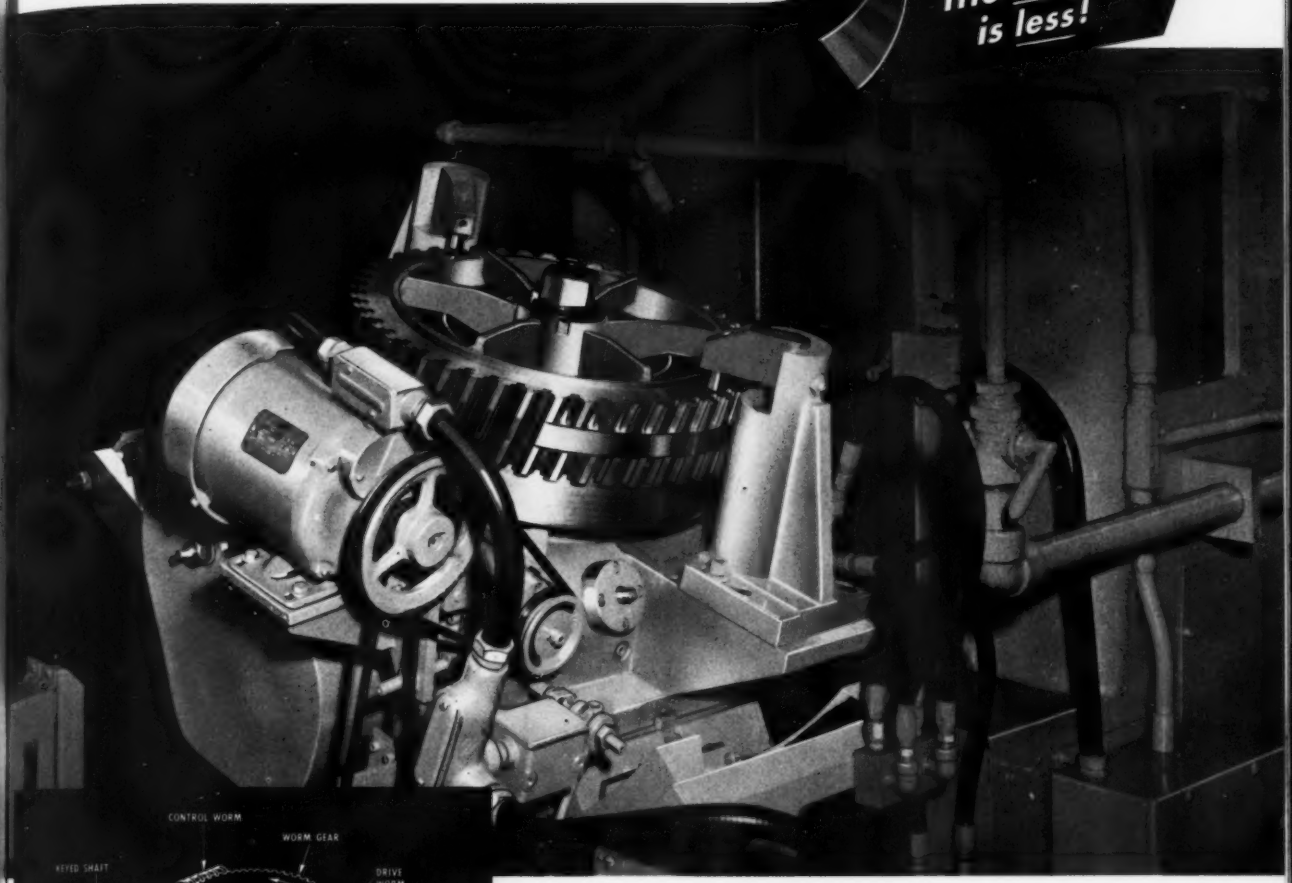
Lining sand-blast barrels with plastisol has increased barrel life from 3 or 4 months to more than 3 years at the Underwood Corporation's Hartford, Conn., plant.

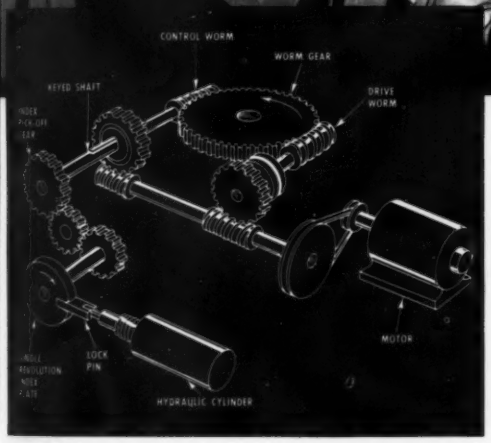
A barrel revolves around a sand blast nozzle as the sand finishes small typewriter parts in the barrel. Unlined barrels wore quickly under the blast and cost $35.00 to replace.

To reduce the cost of replacements and eliminate the inconvenience of changing barrels frequently, Underwood had all barrels spray-coated with Unichrome 5300, a plastisol made by Metal & Thermit Corporation. This coating is a 100% solids polyvinyl chloride composition which is abrasive and chemically resistant. Underwood also uses a similar coating for coating racks and tanks in its plating department.

Since a barrel can be relined, it need not be replaced even after the lining wears out. Cost of the plastisol lining was $58.00. Underwood calculates that savings for the 3 year period total about $385.00 per barrel.

WITH COLONIALS the final cost is less!





Indexing is controlled from a positive pin locked single-revolution index plate. A variable-index gear train connects the plate to the control worm through a keyed shaft. Rotation occurs only during index when the opposed control worm allows the drive worm to move. A continuously running motor does double duty; it provides the indexing power . . . and takes up all backlash in the unit through two slip-type clutches. All gears lock when the index pin locates into the plate. The table index can be from 21 to 250 divisions of a circle depending on pick-off gears used.

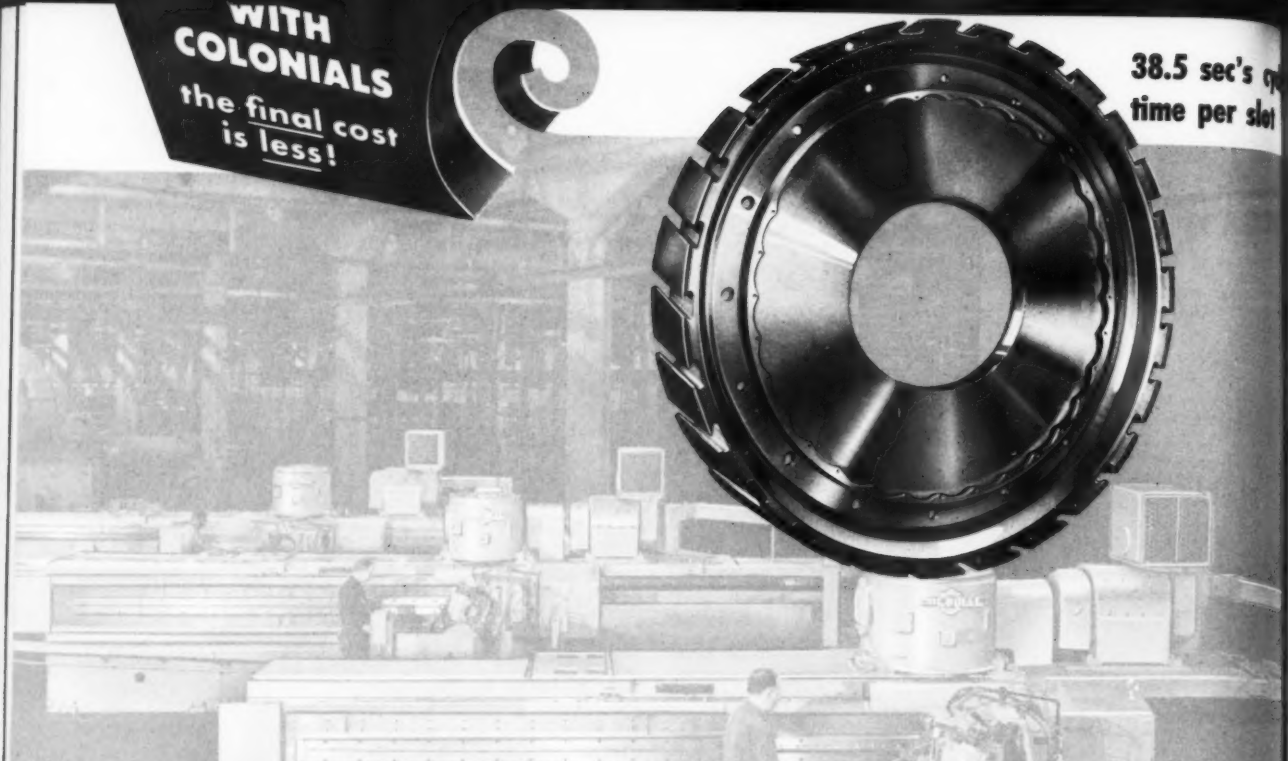
New Positive-Index No-Backlash Table*

COLONIAL now offers truly positive parts positioning and indexing with no backlash at any time . . . works on most machine tools . . . already used in jet engine plants (turn page for a striking example) solving high precision index broaching problems. Fast, versatile, precise. And it stands up under the toughest service. Available in standard diameters of 11, 18 and 28 inches. Can be mounted on either horizontal or vertical cradles. Special diameters and sizes can be supplied to suit application.

Write today for Bulletin JF-57 giving complete data.

COLONIAL BROACH & MACHINE CO.
DETROIT 13, MICH.

WITH COLONIALS the final cost is less!



COLONIALS *new positive-index no-backlash table is used by Ford on the machines which broach the dovetail slots of sixteen different compressor rings. With this equipment Ford gets longer tool life, better finish, and index precision measured in tenths. For this application, the universal table is set for a 28-position index (for fixture details see reverse page). Operation here is: shuttle in; broach at 30 fpm; shuttle out; index (2 seconds). Broach returns (200 fpm); shuttle in; etc.*

How to Broach Tough Materials Fast

Compressor disks for Ford J-57 jet engines are of tough stainless steel or titanium . . . yet call for close tolerances in machining and index. This battery of a 180-inch stroke **COLONIAL** ElectroGear-drive machines is used to produce all sixteen types of disks used by Ford. Average time per slot—including indexing—is less than 40 seconds.

For the newest ideas in broaching make sure you get BROACHING NEWS regularly. Let us know if you are not on the list.

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

FILMS TO SEE

"Two Heads Are Better Than One," a color film, features the No. 680 Series of multiple-head, conveyor-type abrasive belt grinders. Included are action sequences of various models in production on ferrous, non-ferrous, plastic, and other materials. Among the installations shown are a four-head model surfacing chain saw bars in a single automatic grinding sequence, a two-side adaptation finishing both sides of phenolic printed-circuit sheets, and a two-head model equipped with special molded rubber conveyor belt for rapid loading and automatic parts ejection at production rates as high as 5,000 parts/hr. The 16 mm film is loaned by Engelburg Huller Co., Inc., 831 W. Fayette St., Syracuse 4, N. Y.

The role of scientific research in the national economy is highlighted in the movie, "Research—Key to Progress." The film traces the rise and contributions of research, particularly by independent industrial research organizations such as Armour Research Foundation. The 16 mm color movie is made available by Public Relations Dept., Armour Research Foundation, Illinois Institute of Technology, 10 W. 35th St., Chicago 16.

The development of a new way of industrial life for American factory workers through the use of automatic machinery is covered in "Technique for Tomorrow." The film is distributed on a free loan basis by Ford Motor Co., 16 E. 52nd St., New York 22.

"Switching to Safety" tells the story of high reliability pressure switches which are vital "safety centers" in the production of modern aircraft, war missiles, and industrial automation. The 20 min, 16 mm color and sound movie portrays the concept, design, testing, manufacture, and function of these switches which detect malfunction and move to correct it within thousandths of a second. The film is supplied for showing by Cook Electric Co., 380 Madison Ave., New York 17.

"The Pulse of Automation" is a non-technical introduction to the pressure switch and the part it plays in automation. Included are a short historical sketch, the basic fundamentals of a pressure switch and how it operates, and what the switch can do. "The Meletron Story" covers the actual operation of pressure actuated switches. Both 16 mm color and sound movies are loaned free of charge by Meletron Corp., 950 N. Highland Ave., Los Angeles 38.

PRECISION PRODUCTION PROBLEMS?

Here's help from Bausch & Lomb in TOOL DESIGN INSPECTION FABRICATION MEASURING TESTING

NEW! ALIGNMENT INTERFEROMETER

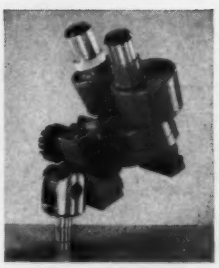
Accurately measures small changes in angle over a range of 30 seconds of arc (±15 seconds). Easy direct scale readings to 0.2 seconds (0.000006″).

BENCH COMPARATOR

Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001″ with optional micrometer stage.

STEREO-MICROSCOPES

Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.

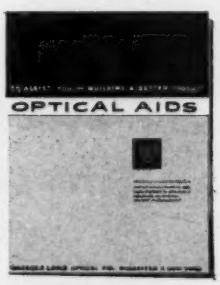


CONTOUR MEASURING PROJECTOR

Shows magnified silhouettes or surface views. Simple operation, highest precision measurements: to 0.0001″, linear; to 1 minute of arc, angular.

OPTICAL AIDS CATALOG

Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Microscope Bodies, Micrometer Discs, Wide Field Tubes, Brinell Microscopes, Shop Microscopes.



NEW TOOLMAKER'S MEASURING MICROSCOPE

Quickly measures opaque or transparent objects of any contour. Linear, accurate to 0.0001″; angular, to 1 minute of arc.

MAIL COUPON TODAY FOR VALUABLE DATA

BAUSCH & LOMB OPTICAL CO.
79817 St. Paul St., Rochester 2, N. Y.
Please send literature on optical production aids checked below:

☐ Alignment Interferometer ☐ Bench Comparator ☐ Contour Measuring Projector ☐ Toolmaker's Microscope ☐ Stereomicroscopes ☐ Optical Aids Catalog

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....
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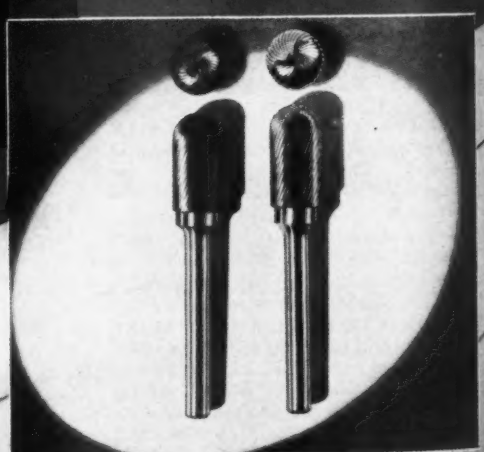
BAUSCH & LOMB
SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 139

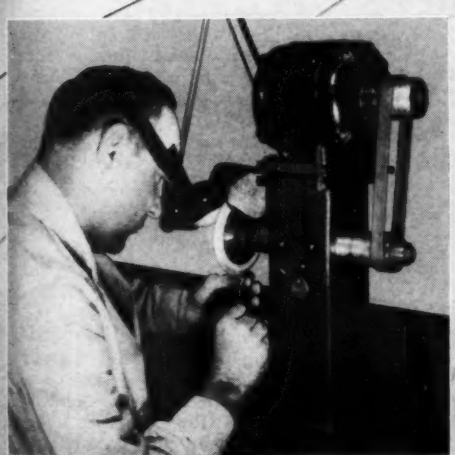
NOW *Carbide Burs are* EXPEN



Compare the Atrax automatically-ground carbide bur (right) with the manually-ground bur (left). Note the accurate, uniform fluting, sharp cutting edges and gem-like finish of the Atrax bur.

DABLE!

Automation By Atrax



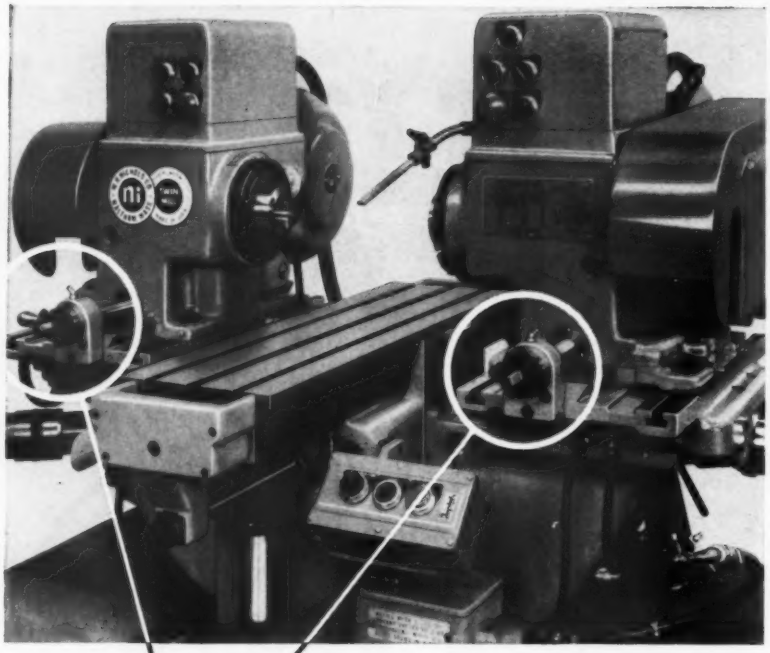
Manual bur grinding is obsolete. It is a tedious operation, costing much more than Atrax automatic grinding. Flute uniformity depends entirely upon the skill and patience of the operator.

For the first time in the history of metalworking, carbide burs are being produced completely automatically! The manually-ground bur, costing 10 to 20 times more than high speed steel, is obsolete. Exclusive Atrax automated grinding is many times faster than hand grinding . . . cuts time and labor costs so low that Atrax Carbide Burs are now expendable tools!

Manual bur grinding is an expensive, time-consuming operation, much less accurate than Atrax automated grinding. Atrax Automatic Bur Grinders produce precision carbide burs—eliminate human error—insure absolute uniformity of bur size, shape, concentricity and fluting. Automated bur grinding is an exclusive Atrax development—proof again that Atrax, the leader in solid carbide tooling, can save money for every user of carbide and high speed steel burs!

Send for the new Atrax Catalog listing more than 850 standard Carbide Burs . . . products of Automation by Atrax.

THE ATRAX COMPANY • NEWINGTON, CONN.



NICHOLS TWIN MILL...
SOMETHING NEW HAS BEEN ADDED

Now, the Nichols Twin Mill offers dovetail slides with micro-feed screws for *longitudinal* adjustment of milling heads, as well as transverse and vertical screw adjustments. With this new feature, the Nichols Twin Mill provides SIX-WAY ADJUSTABILITY FOR EACH MILLING HEAD IN SECONDS!

Adaptable for long or short-run jobs. The scope of Nichols Twin Mill utility is limited only by the imagination of the user.

THINK: Two geared milling heads—each completely independent with independent drives, push button controlled. Wide range of spindle speeds—55 to 2050 R.P.M. Vertical Head available for either or both spindles. Automatic Table cycle with rapid approach, hydraulic-controlled variable cutting feed and rapid return.

THIS MEANS: The Milling Heads may be directly opposed or offset longitudinally, vertically or transversally. Ferrous or non-ferrous materials can be milled with HSS or carbide tipped cutters. IT ALL ADDS UP to top production with fine finish while TOLERANCES TO TENTHS are maintained with ease.

Complex light milling jobs can be milled faster and more economically with the Nichols Twin Mill. "Two Heads are better than one—for sure".

WRITE OR PHONE FOR FULL DETAILS—CATALOG.

Manufactured by W. H. NICHOLS COMPANY

National Distributors

THE ROBERT E. MORRIS COMPANY

5007 FARMINGTON AVE. • WEST HARTFORD 7, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 142

At Your SERVICE

A specialized high speed steel forging service for tool, die, and special machine makers has been announced by Smith-Armstrong Forge, Inc. of Cleveland. High speed steel is forged to exact customer specifications in flats, rounds, rings, bushings, etc. The company also supplies a rough and finish machining service if specified.

◆

The Datics Corp., a new Fort Worth, Tex., firm, offers services for large-scale computing, data processing, data reduction, consulting, and research and development in related areas. The company provides its personnel and equipment on a contract basis to solve a wide variety of problems.

◆

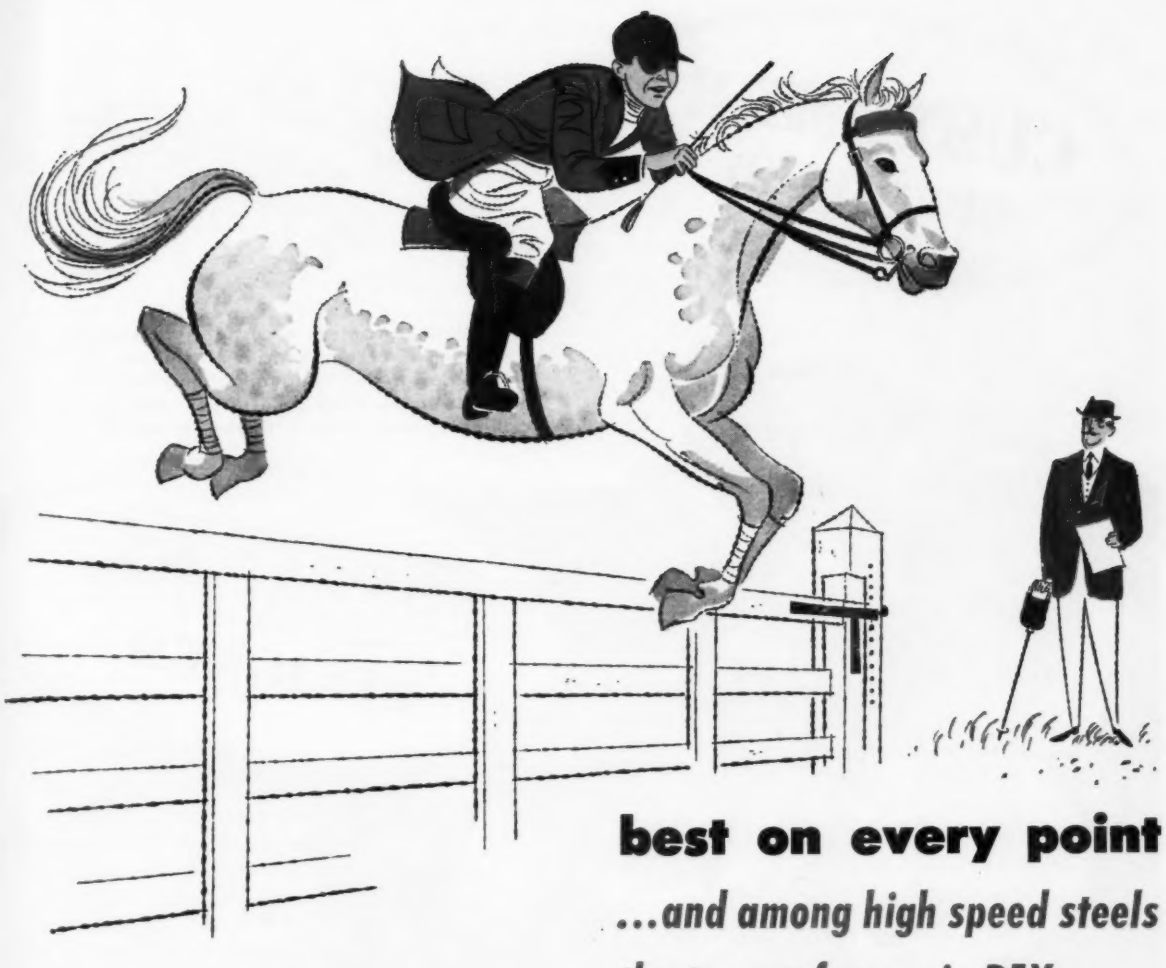
Automotive Fabricators, Inc. of Detroit is devoted exclusively to precision prototype parts and experimental stampings. The company produces zinc alloy dies, welded fabrications, die models and plastic duplications, experimental stampings, short run stampings, and hand made samples. Featured is the welding of aluminum, as well as the making of experimental sheet metal stampings. The company serves the automotive and aircraft industries from blueprint to finished product.

◆

Rolled Alloys, Inc., located in Detroit and South River, N. J., is the world's largest distributor of heat and corrosion resistant alloys. More than 400 items are carried in stock and are available for immediate shipment. Rolled heat resistant alloys are supplied in sheets, plates and bars. These high alloy steels are used by those requiring parts that normally operate at constant elevated temperatures. Among the uses for these parts are turbine engines and industrial furnaces.

◆

Christopher Tool & Die Co. of Cleveland is designing and manufacturing dies, gages, jigs, fixtures, and special machinery for the metalworking industry. For the aircraft and electronics industries, the company produces precision component parts with unusually critical tolerances. In addition, carbide and carbide-inserted wear parts are made for the aircraft, electronic and automotive industries.



best on every point

...and among high speed steels the top performer is REX

To leap the hurdle of competition, a product needs performance born of quality. And Crucible's REX® high speed steel has it – in accurate size . . . sound uniform structure . . . dependable response to heat treatment . . . optimum tool performance.

Now, thanks to improved manufacturing techniques, REX is even better – more uniform. Put it to work on your next job, and you'll quickly know why REX is today, as it has always been – *the standard by which all other high speed steels are compared.*

Call for REX at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for a list of available data on REX and other Crucible *special steels*, write now for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

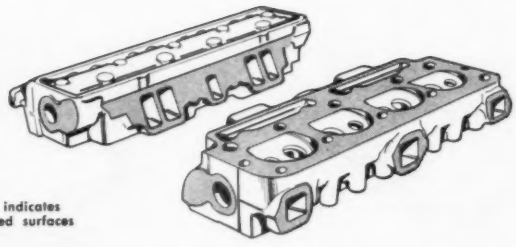
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 143

CUSTOMER SPECIFIED



Tone indicates machined surfaces

A leading automobile company requested Kearney & Trecker's Special Machinery Division to design and build an automatic transfer machine to perform a series of milling and drilling operations on V-8 cylinder heads.

KEARNEY & TRECKER MILWAUKEE® DESIGNED

Kearney & Trecker built this 12-Station Automatic Transfer machine which rough and finish mills the head gasket surfaces, mills intake and exhaust port surfaces and both ends, and drills, counterdrills and reams two holes on each of two cylinder heads for V-8 engines. Machine's production rate is 100 pieces per hour.

The two cylinder heads progress automatically through the machine side by side, each on separate transfer rails. Transferring, locating, clamping, lubrication and chip disposal are all automatic.

For more information on machine illustrated, ask for Data Sheet No. 1080. A new bulletin, SMD-56, which describes many of our outstanding designs, is also yours for the asking.

Production efficiency starts with Kearney & Trecker Milwaukee machine tools

This typical example reduced costs and meant higher production for the buyer. Kearney & Trecker's Special Machinery Division's 50 years' experience in machine design and manufacture can mean considerable savings to you.

Take advantage of our abilities. They can pay off in profits for you. See or write your Kearney & Trecker Special Machinery Division representative. He will be pleased to give you all the details on this production machine. Contact him today!

KEARNEY & TRECKER MILWAUKEE

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Designers and Builders of Precision and Production Machine Tools Since 1898

CIRCLE INFORM-A-GRAM KEY NO. 144

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411 Williams St., N.W.

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1712 Seventh Ave. North

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Stedfast & Roulston, Inc.
11 Deerfield St.

BUFFALO 23, N.Y.
Syracuse Supply Co.
1965 Sheridan Drive

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CIRCLE INFORM-A-GRAM KEY NO. 144

. . . Training from page 98

tion quality planning which deals with the systematic allocation of the right equipment, the use of the right people and the designation of the characteristics important to the products quality.

And, of course, we train our engineers in the important aspects of mechanization and automation, especially in those areas where quality control's effect may largely influence the profitability of an operation.

Do we train our quality control engineers in statistical methods? Of course we do. But we impress them that this phase of training concerns a tool that can be beneficially used at the right time and in the right place and it is simply a part of the much more important job of complete quality control.

For inspection and test, we include these subjects which deal with in-process quality auditing methods, final quality audits, methods for ably handling daily quality problems, and also basic statistical methods which can be helpful at the right time in doing a better job more economically.

Yes, gentlemen, the exciting days of the control chart, Mil Std. 105A and other statistical methods by themselves are swiftly becoming a monument to the evolution of a much more effective management quality method — that of modern quality control. And, training in this new concept demands that we come to grips with all the methods and all the technology required to prevent poor quality before production starts.

We must translate these methods and technology into their simplest possible forms. And finally, train our key quality people in this modern approach to quality control.

end

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CIRCLE INFORM-A-GRAM KEY NO. 1452

MEN YOU SHOULD KNOW

The newly created position of director of manufacturing research for Whirlpool-Seeger Corp. is being filled by **Otto Krauss.** He is responsible for coordination and analyses of manufacturing methods, processes, tools and equipment through the company's seven manufacturing divisions. Succeeding Mr. Krauss as general manager of the St. Joseph Division is **Glenn A. Evans. Jasper F. Burt** has been promoted to general manager of the company's Marion (Ohio) Division. **S. J. Smith** will succeed Mr. Burt as La Porte Division plant manager.

◆

The appointment of **Donald E. Brown** as chief engineer, Glendale Division, has been announced by Consolidated Electrodynamics Corp.

◆

Hal O. Gummere has been elected executive vice president of Buckeye Tools Corp.

◆

The election of **James R. Keough** as vice president for manufacturing has been announced by Fenwal Inc. In this capacity, he will have executive responsibility for all manufacturing and purchasing operations for the company's plants in Ashland and Framingham, Mass.

William R. Jennings has been promoted to manager of the Machine Tool Division of Axelson Mfg. Co., division of U. S. Industries, Inc. He has been with the company since 1920.

◆

Ernest S. Griswold has been appointed chief product engineer of the Cutting Tool Division of Pratt & Whitney Co., Inc. He succeeds **John S. Gibson** who has become chief engineer of Illinois Tool Works.

◆

Oscar L. Joseph has been named manager of the Ann Arbor plant of the Barnes-Gibson-Raymond Division of Associated Spring Corp. He succeeds **Melvin E. Donally,** who has retired. **H. Perry Smith** has joined the firm as assistant director of research. He will be located at the new research center in Bristol, Conn., where he will be in charge of setting up facilities for an expanded program of research and product development.

◆

Industrial Tectonics, Inc. has disclosed the appointment of **Dalton H. Miller** as general manager of the recently completed special bearing plant in Compton, Calif.

The promotion of four men has been announced by Lees-Bradner Co. **Don Goodwill** has become chief engineer and **Ted Masaitis,** chief of the Machine Design Section. The new head of the Cri-Dan Division is **Anson Laufer** and **John Montean, Jr.** has moved up to assistant of this division.

◆

Stewart G. Fletcher has been promoted to vice president-metallurgy by Latrobe Steel Co. In this position he is responsible for all metallurgical activities concerned with the company's products.

◆

Horace W. Whitman has been appointed general manager of the Machine Division of The Torrington Mfg. Co. He will supervise sales, production, engineering, and purchasing activities for the company's wire-forming and rolling mill products.

◆

J. C. Drader has been named vice president-research and **H. Pelphrey** has taken over as director of engineering research for Michigan Tool Co. There are new posts created by the company's expanding work in the gear development field.

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CIRCLE INFORM-A-GRAM KEY NO. 147

MEN YOU SHOULD KNOW

Several managerial appointments in the newly-formed Magnetic Materials Section of the Metallurgical Products Department of General Electric Co. have been announced. **R. J. Studders** has moved into the position of manager of engineering and **R. A. Canning** has become manager of manufacturing. **Anthony J. Gizzi** is serving as manager of the specialty resistor project. An applied mechanics engineering group is headed by **H. J. Siekmann** as manager.

◆

The new executive vice president of Ford Motor Co. is **D. S. Harder.** In addition to his present responsibilities over the basic manufacturing divisions, he will be in charge of all truck, car and tractor divisions. **Andrew A. Kucher** has taken over as director of the engineering staff.

◆

Appointment of **Frederick J. O'Reilly** to the newly created position of general manager of manufacturing has been disclosed by National Electric Products Corp. His responsibilities include manufacturing operations at the company's main plant in Ambridge, Pa., as well as the Elizabeth, N. J., facility.

Two promotions in the manufacturing division of Hughes Aircraft Co. have been announced. **George H. McKaig** has become manager-production planning and **James T. Jones,** manager-production engineering. Mr. McKaig is in charge of electronic and mechanical production planning. The administration and coordination of all production engineering activities in the electronic manufacturing division falls to Mr. Jones.

◆

The position of chief engineer for the Denison Engineering Division of American Brake Shoe Co. is being filled by **Leroy E. Bonnette.**

◆

H. E. Pollard has been appointed chief engineer of the Lindberg-Fisher Division of Lindberg Engineering Co.

◆

Robert J. Dubuc has taken over as manufacturing manager of The Gear Grinding Machine Co.

◆

Morris W. Leen has been named senior design engineer and supervisor of the Military Products Design Section of the Omaton Division of Burndy Corp.

Charles R. Lewis has been made assistant chief engineer and **Hans M. Gadebusch,** special projects engineer for the GMC Truck and Coach Division of General Motors Corp.

◆

Paul F. Maize, engineering expert in the development of special equipment for automotive production, has joined the staff of the Cyril Bath Co. He will serve as chief consultant to the automotive trade in the application of the radial draw forming principle to the production of body and trim parts of sheet metal, with headquarters in Detroit.

◆

Automation Development Corp. has announced the election of **George C. Meibuhr** as vice president of engineering.

◆

The position of vice president and general manager of Press Automation Systems, Inc. is being filled by **Thomas M. Ryan.**

◆

Charles E. Smith, Jr. has moved into the position of factory manager of Flexible Tubing Corp. He will direct the company's overall manufacturing operations in six divisions.

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CARBIDE TIPPED SOLDERING JIGS SIMPLIFY OPERATIONS

Resistance of cemented carbide to wear and to deterioration at temperatures involved, is a key factor in assuring accuracy while silver soldering band instrument key assemblies in the plant of H. & A. Selmer Inc.

Besides resisting excessive oxidation in soldering operations, the use of carbide jig elements saves hours of hand filing and other cleaning procedures. Once cemented carbide is coated with a thin tight layer of oxide, the silver solder and the nickel-silver key components themselves do not stick to the carbide at soldering temperatures of 1500 to 1600°F.

In silver soldering key assemblies for flutes and clarinets, Selmer makes use of hundreds of different sets of jigs for locating and holding the tiny parts. Depending on the assembly involved, the jigs are designed to handle from three to as many as seven tiny shapes while the operator is manipulating the gas torch and soldering wire.

Five parts of a clarinet key assembly are being silver soldered here. Carboloy grade 883 carbide jig positioning and locating points provide consistent accuracies by resisting heat and oxidizing action resulting from soldering.

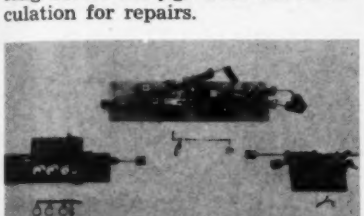
Before using carbides, stainless steel was used for jig elements. On most jigs, these consisted of a visual guide bar and positioning and holding pins. The pins, in some cases, are fixed for positioning and, in others, are located on the ends of rods which can be adjusted to position and hold the tiny instrument parts while the solder and flame are applied.

A typical soldering operation involving a jig assembling five different key components is shown in one of the illustrations. Assembly here consists of a small piece of wrought tubing, two nickel-silver castings, a pad cup of sheet metal and an adjusting lug.

In the soldering operation, the tube is positioned between the two end pins of the jig acting as a bearing for the key. In other words, it is the foundation for the castings, pad cup and the adjusting lug.

The visual guide in the jig helps the operator keep the various parts in correct alignment, while the adjustable pins enable her to position, and hold the parts while applying the torch, and the 45% silver alloy soldering wire.

Although stainless steel was the best material that could be used for the elements at the time, soldering conditions still were far from ideal. There were too many instances of keys being soldered to the jigs. Every time that happened, filing would be necessary, which meant some of the key components, as well as important elements of the jigs would be filed away as well. It did not take long before the jigs were out of circulation for repairs.



Three of the many jig assemblies used by H. & A. Selmer Inc. Carbide-tipped positioning and holding points provide soldering accuracy in joining key assemblies shown below each jig.

Today, with the application of a Carboloy cemented carbide supplied by General Electric's Metallurgical Products Department, soldering operations are greatly simplified. Filing no longer is an operator chore, and the jigs remain intact to provide the accuracies needed in assembling the instrument key components. The carbide jig elements also make a further contribution to accuracy by resisting wear induced by the oxidizing action resulting from the oxygen and city gas flame employed in the soldering operations.

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Manufacturers engaged in the production of extruded light metals, particularly aluminum, can achieve substantial savings by using the spray method as opposed to conventional methods of die lubrication, according to The DeVilbiss Co.

Installations now in use show the following advantages of the spray technique over brushing or swabbing on the die lubricant:

1. The lubricant, which usually contains a caustic to dissolve particles adhering to the die, is in a sealed container, eliminating the possibility of dripping, spilling, splashing, and contaminating and

. . . Continued on Page 153

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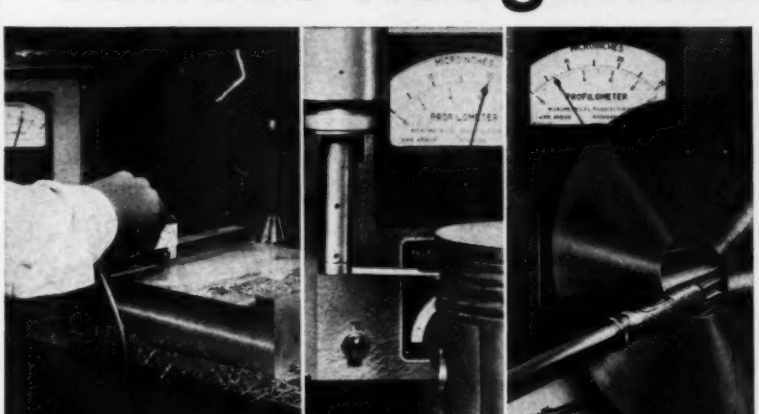

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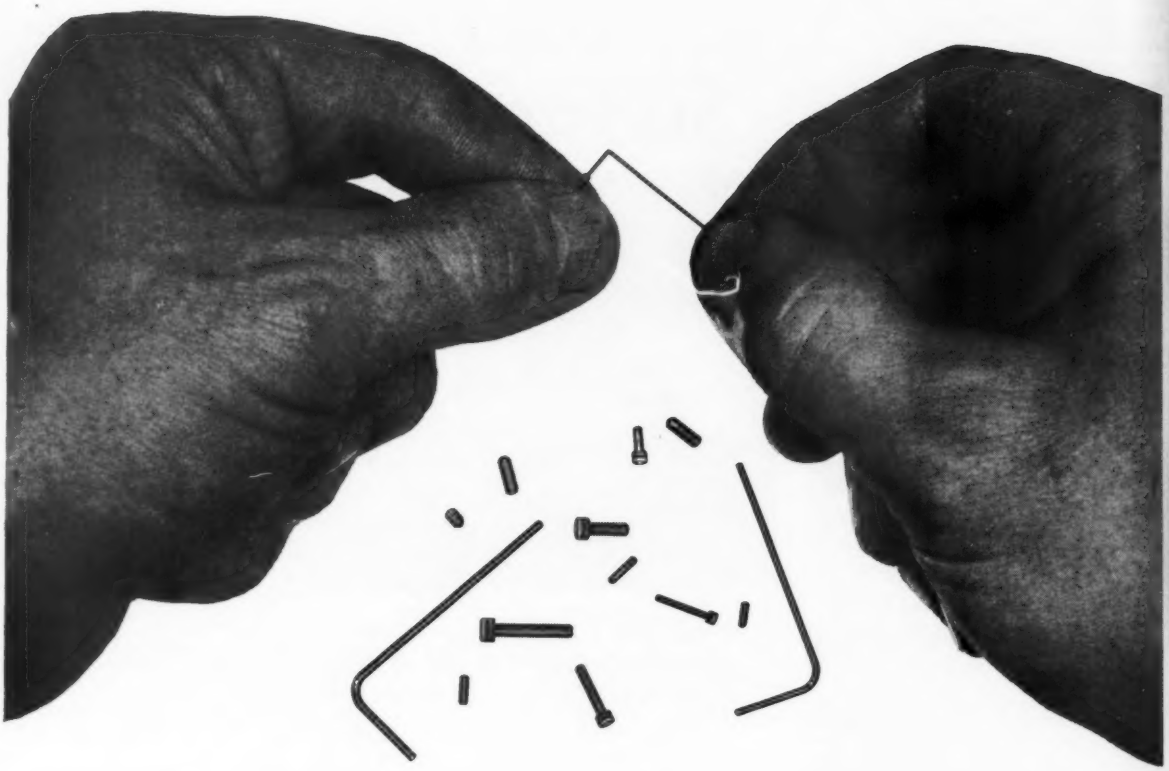
CIRCLE INFORM-A-GRAM KEY NO. 149



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. . . Spray from page 149

providing full safety for the operator.

2. Atomization of the material and velocity provided by the spray system forces the lubricant deep into the die and insures coating all vital surfaces.

3. Use of an extension on the spray gun permits the operator to lubricate the die without placing any part of his body in the machine, another safety feature.

5. The spray system is many times faster than hand lubricating.

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DeVilbiss engineers recommend a die lubrication spray installation composed of a hand spray gun with a 30" extension, a 15-gal material tank with hand agitator, and hoses.

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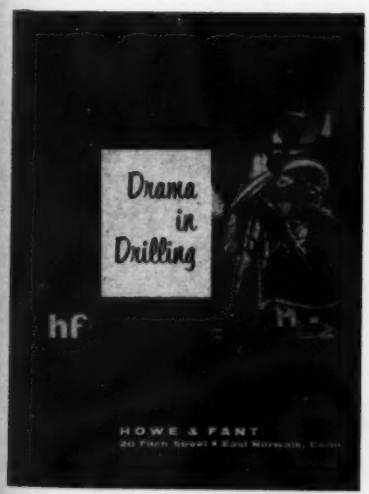

Each application is illustrated and the accompanying text identifies the material being worked, and lists the tooling required and operations performed. Also given is the actual production time per piece.

For your copy of "Drama in Drilling," write to Howe & Fant, Inc., Dept. TP-1, 20 Fitch St., E. Norwalk, Conn.

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CIRCLE INFORM-A-GRAM KEY NO. 153

REDUCE PIN DEFLECTION AND DIE MAINTENANCE with SUPERIOR N-K DIE SETS

Overcome Forces that Cause a Die to Shear Itself, Chip Its Cutting Edges, Break Punches, Produce Irregular Break Lines and Cause Large and Irregular Burrs on the Parts Produced.

Superior N-K Die Sets incorporate welded bosses around pins or bushings to increase the accuracy and durability of the die set. These welded bosses shorten the unsupported pin length which in turn greatly reduces pin deflection. Misalignment caused by press irregularities, irregular forces and thrusts within the die itself are minimized, because N-K Die sets bring the pivot point down to or below the cutting plane.

Send for FREE Catalogue containing helpful data on Superior Die Sets and Die Makers' Supplies.

5 TON SUPERIOR N-K DIE SET

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

For Fast Local Service Call These Superior Representatives

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PLANTS AT—Milwaukee, Wis.—Mitchell 5-6027 and Plainville, Conn.—Sherwood 7-2761

CIRCLE INFORM-A-GRAM KEY NO. 154

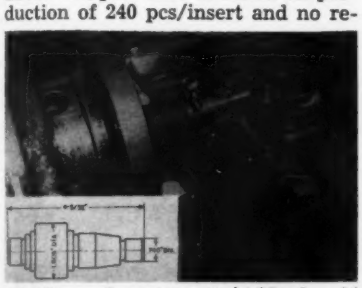
THROW-AWAY INSERTS REDUCE TURNING COSTS BY SIX-SEVENTHS

Selection of the best type and style of carbide cutting tool, as well as the best tool tip material, has paid off well for the American Pulley Co. in turning out small countershaft pinions.

Tool cost was cut to approximately one-seventh with "throw-away" type insert tools which replaced vertically-clamped, prismatic type carbide insert tools.

Production of these pinions, which are turned out of a bar of SAE 4140 chrome-moly steel of 212 Brinell hardness, consists of turning the various diameters on both ends of the workpiece at 0.0138" feed, ¼" maximum depth of cut, and 720 rpm or 303 max. sfpm. Three cuts are required on each end.

The job is now being done with Kennametal's standard Kendex positive rake tool Style KTAR-16C with Grade K21 triangular insert, Style BTC-12. With this tool the cost is about 47¢/pc. This is based on production of 240 pcs/insert and no re-



grinding. Inserts cost $1.05 plus 9¢ for a chip breaker plate, pro-rated over the life of 10 inserts. Tool cost, exclusive of the tool holder, is therefore $1.14 for 240 pcs.

The prismatic type insert tool, which normally has a negative back rake, was given a neutral rake by grinding a chip breaker along the insert cutting edges. However, frequent breakage occurred and the best life obtained was 10 pcs/cutting edge as compared with 80 pcs/cutting edge on the Kendex inserts. Since both ends of the prismatic type inserts could be used, 60 pcs/grind were turned and a total of 600 pcs/insert with the original and 10 regrinds. Cost of these inserts is $6.20 and regrinds cost $1.80 for both ends. Total cost of inserts and 10 regrinds was therefore $24.20 for 660 pcs or 3.6¢/pc as compared with less than ½¢ for Kendex "throw-away" insert tools.

The effect of tool holder cost on tool costs is omitted here because it must be pro-rated over the life of each holder in terms of an unknown number of pieces produced per holder. The original cost of the Kendex tool holder is less than the more complex holder for prismatic inserts. Turning was done on a Monarch air tracer lathe of 25 hp.

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
6104S	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

Send today for the New Nelco Catalog showing over 700 carbide tipped cutting tools.

NELCO TOOLS

For that EXTRA Edge in Production!

Nelco Tool Co., Inc. • Manchester, Conn.

Increase output . . . reduce costs!

Costly, time-consuming trimming and notching operations can be done in one operation with a Brehm Trimming Die. Don't worry about stock thickness. Edges will be of full thickness—clean, flat, without burrs or distortion at the trimmed edge.

Other Brehm Die advantages! **Workable Materials**—gold, silver, stainless or mild steel, copper, brass, zinc, aluminum, fiber, rubber, plastics. **Quantities vary**—stove or refrigerator doors, auto bumper buffers or typewriter covers, from 264 to 900 per hour. Intermediate parts, where stock and scrap can be blown from the die, about 1200 per hour. **Shapes**—fountain-pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. Almost anything *you* need trimmed.

A Brehm "Shimmy" Trimming Die with angular cams, cuts four ways in one press stroke, handling straight or curved edge contours, with multiple notches and projections. Slow, costly "horn" and "pinch" trimming operations, are eliminated.

Submit part prints of not only the shell to be trimmed but for all related dies for our quotation.

THE "SHIMMY" REG. DIE

Brehm® TRIMMING DIES

SERVICES OF

YOUR TOOL ROOM in DAYTON

Engineering Processing Building

Tools . . . . Dies . . . . Special Machines

Vulcanaire Jig Grinders Motorized Rotary Tables

Brehm "Shimmy" and related dies. Automation

VULCAN TOOL CO. 731 Lorain DAYTON 10, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 156

COMBINING ENGINE BALANCING WITH MANUFACTURING TESTS

Dynamic balancing of automobile engines while operating under their own power and at normal operating speed, is being performed at the Ford Motor Company.

Ford, in cooperation with the International Research and Development Corporation, has been able to combine the balancing process with an already existent test operation at the point of engine manufacture.

Two vibration pickups (Fig. 1) are placed on the engine simultaneously, one pointing to the front or V-belt pulley correction plane, and the other to the rear or flywheel correction plane. Alternating currents generated by the pickups respond to

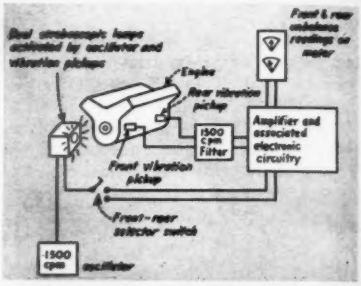

Dual stroboscopic lamps activated by oscillator and vibration pickups
Front & rear unbalance readings on meter
Engine
Rear vibration pickup
1500 cpm Filter
Amplifier and associated electronic circuitry
Front vibration pickup
Front-rear selector switch
1500 cpm oscillator

Fig. 1. Schematic view of layout for electronic-dynamic balancing of automobile engines.

Fig. 2. Hot-test stand operator checks angle of unbalance at front and rear of engine with stroboscopic light shining on front pulley of engine.

the mechanical motion of the engine and are in proportion to the vibration amplitude and the speed of the engine. The phase of the electrical output bears an established relationship to the physical location of unbalance. And because all engines are balanced at 1500 rpm, output of the pickups after amplification and integration is in direct proportion to the ounce-inches of unbalance at each end of the engine.

Other signals to indicate engine speed and position of unbalance at front and rear of engine are fed from an electronic brain to a stroboscopic

. . . *Continued on Page 158*

Introducing...

the Kodak Contour Projector, Model 14-6, with Measuring Table

• Makes fixturing easier and setups faster with table cross travel of 3"; vertical travel of 2⅛". Focusing travel is 1½".

• Provides rapid horizontal measurement to the order of .0002" for toolroom as well as production use. Simplifies gaging of larger parts—less need to reposition.

• Slotted worktable—19¼" x 8"—permits use of standard fixtures for staging wide variety of parts. Throat clearance is 14¼". Maximum lens height above table, 4¼"; minimum, 2⅛".

THE Model 14-6 is equipped with the same high-quality, precision optical system as all other Kodak Contour Projectors. Kodak's famed Ektar Projection Lenses and rigidly built lens mounts and housings insure accurate performance year after year. A full 14-inch viewing screen covers a field of 1.4" at 10× magnification. Coated lenses which increase light transmission—plus a special Fresnel lens back of the screen—give a bright image, permitting you to use the Model 14-6 anywhere in the plant. Accessory projection lenses provide a choice of six magnifications (10×, 20×, 31¼×, 50×, 62½×, and 100×). All lenses are quickly interchangeable, seat positively for precise rated magnification. Air-cooled lamphouse and simple, handy controls assure operator ease and comfort.

Vertical illuminator, surface illuminator, six-lens turret, rotating screen with protractor ring, and a mobile base are available as accessories. For further information about the new Kodak Contour Projector, Model 14-6, write to:

Apparatus and Optical Division

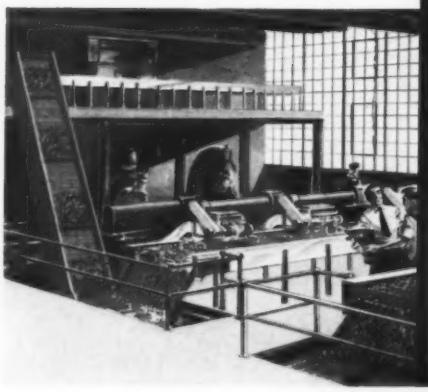
EASTMAN KODAK COMPANY • Rochester 4, N .Y.

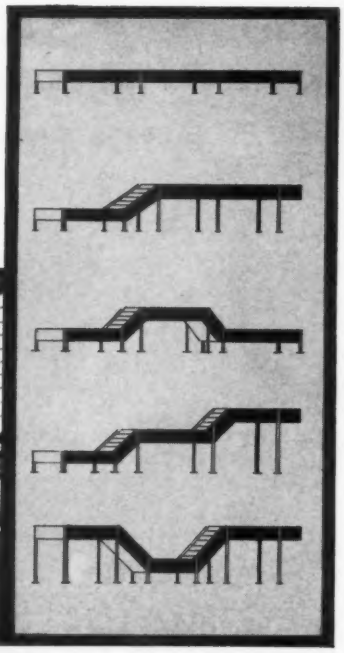
Kodak

CIRCLE INFORM-A-GRAM KEY NO. 157

MAY-FRAN

CONVEYOR STANDARDIZATION





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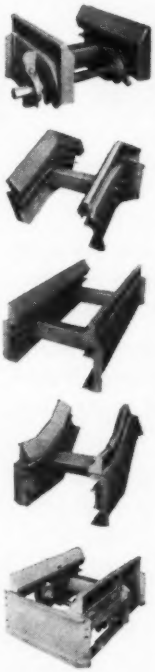
. . . NOW AND IN THE FUTURE!

Here is a conveyor program designed for the unusual. NOW . . . you can have a customized conveyor today to meet production needs . . . and with modification, that same conveyor will meet the needs of tomorrow.

The May-Fran conveyor standardization program provides the standard components that can be assembled to form a special or standard conveyor. These same components can be re-arranged at any time to solve production problems in the future.

In addition, standard components mass produced mean conveyor economy right from the beginning.

Here is a conveyor program of standardization program that saves you money now . . . and in the future!



Write today for your copy of Bulletin MF-200

MAY-FRAN ENGINEERING, INC.

1726 Clarkstone Rd., Cleveland 12, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 158

light unit mounted by the front engine pulley. The unit contains two stroboscopic lights, one triggered by a 1500 cpm oscillator and the other by each vibration unbalance sensed by the pickup. At 1500 rpm engine speed, the front pulley appears "stopped" when viewed under the stroboscopic light. A second stroboscopic light is engaged to observe a previously placed chalk mark on the front pulley. Position of the chalk mark shows the location of unbalance at the front and rear of the engine, by means of a two-position switch on the stroboscopic unit.

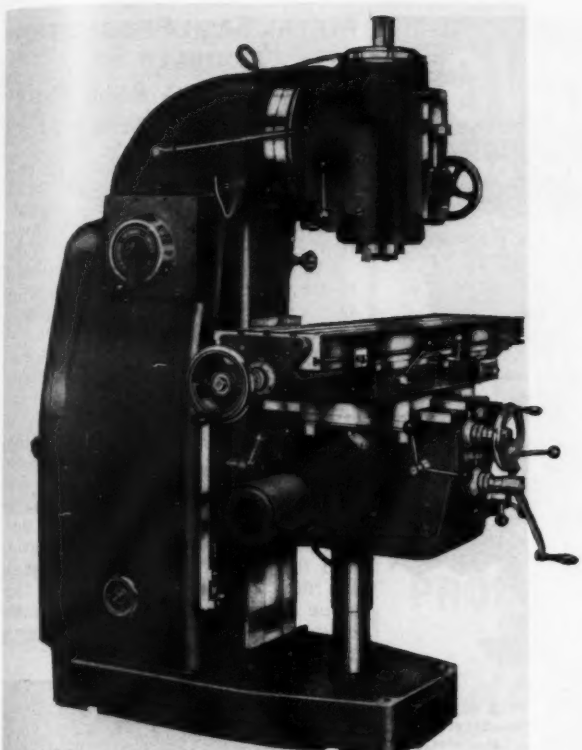
Once the amount of unbalance and location are established, an air tool is used to drive proper size weights into pre-drilled holes in the flywheel or the front pulley — and the engine is in fine balance.

BROADER HARDENING RANGE DEVELOPED FOR SPECIALTY TOOL STEEL

Stentor, an oil-hardening non-deforming tool steel manufactured by The Carpenter Steel Company, can now be hardened safely over a broader range of temperature than was previously permissible. The new hardening range, 1425 to 1525°F, has been made possible without change in the simplified analysis or any other of the traditional safety features of this alloy such as freedom from decarburization, minimum size change, uniform hardenability, and elimination of the preheating required for many other tool and die steels.

Difference in the hardening temperatures of the various oil-hardening non-deforming tool steels has occasionally caused scheduling problems in some heat treating departments. Tools and dies made from other grades that require hardening temperatures in the range from 1475 to 1525°F could not be hardened satisfactorily in the same batch as Stentor tools and dies, since the hardening range for Stentor was 1425 to 1450°F. The new wider hardening range of Stentor makes it possible to fit it into many heat treating schedules during the average day.

For minimum size change of less than 0.0004"/in, hardening from 1425°F is still recommended; however, the broadened hardening range expands the safe hardening limits. Stentor will increase in size about 0.001"/in when hardened, but when drawn between 300 and 400°F it will return to within 0.0004"/in of its original size. Because of this minimum size change and the freedom from decarburization in heat treatment, Stentor tools are used without grinding after hardening.



VF-54

ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers At Such Surprisingly Low Cost

HORIZONTAL AND VERTICAL SAJO MILLERS

Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.

Standard Duty #2 (Model 54) ALL GEARED Millers—

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

•

Light Duty #2 (Model 53) ALL GEARED Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

Light Duty #2 (Model 48) Utility Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

PF-54

austin INDUSTRIAL CORPORATION

76-X MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

CIRCLE INFORM-A-GRAM KEY NO. 159

Are You *SHARING*

the production advantages of

DPS POWER METHODS?

Widespread applications by the thousands prove this modern ASSEMBLY EQUIPMENT to be highly profitable and fully adaptable to your special requirements!

5 SCREW-DRIVING MACHINES
Bench and Pedestal Types
Pedestal Model A pictured

INCREASED OUTPUT
TIME SAVING
PROFIT PICK-UP

RESULTS OF THIS "HORN O' PLENTY" METHOD!

BOWL FEEDER
Electrical vibratory type to feed parts that cannot be tumbled.

BARREL FEEDER
with stationary ring cover for heavy-duty production.

BARREL FEEDER
Popular motorized type, for parts requiring critical selection.

DETROIT POWER SCREWDRIVER CO.

Write for Literature Today!

2827 W. FORT STREET • DETROIT 26, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 160

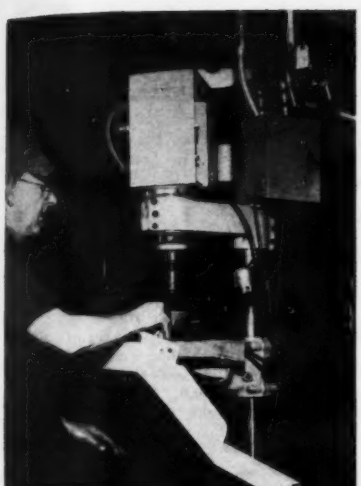
METAL SASH PRODUCTION DOUBLED BY AUTOMATING ASSEMBLY JIG CLAMPS

Production of metal screens and storm windows has been doubled at the Airtite Corporation by automating their assembly jigs with PowRlock setup clamps.

The assembly jig illustrated is used to permanently stake the corners of sash frames. Formerly, the jig was equipped with manually operated, cam-type plungers that had 18" extension handles. The operation was not only slow, but involved the fatiguing and monotonous type of physical labor that cuts production and efficiency rates. PowRlock clamps were installed to replace the plungers, and were placed horizontally, to exert equal force at a 90° angle. This made the jig automatic, and the only labor now required is the flick of a switch. Exactly the same jig is being used, by the same operators, but production has been multiplied by two.

PowRlock, a standard product of Wilton Tool Mfg. Co., Inc., is a new tool that can be used with practically any machine tool, jig, or fixture. Originally designed to replace manual setup clamping on machine tools, the PowRlock consists of an air hydraulic power system that operates a powerful, compact clamping head. Heads can be installed vertically or horizontally, to supply locking force or a power stroke. Up to 16 heads can be operated simultaneously from one control, and the power exerted is determined by the size of the booster and the pressure used. At Airtite Corp., two Model 2352 heads are operated from one air booster, at 60 psi, airline pressure, and each head exerts 3600 lbs of force. This force could be increased to 6000 lbs by raising air pressure to 100 psi.

BUY U. S. SAVINGS BONDS!



Unique Head on Drill Press Speeds Production 2½ Times

Drilling 5/32" holes 3/8" deep, in tough forged rivets is a requirement in the production operations of the Bradley Washfountain Company, Milwaukee, Wisconsin.

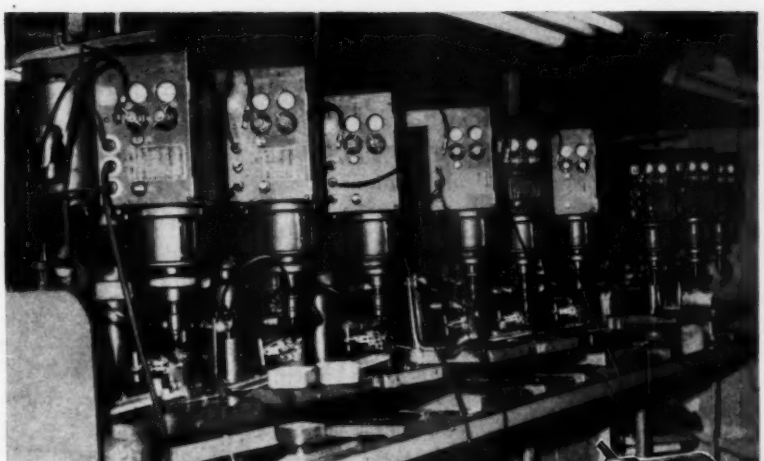
Former methods produced only 125 pieces per hour with very high drill breakage due to the hard stringy metal. How to reduce drill breakage and increase production was an ever present problem with this manufacturer.

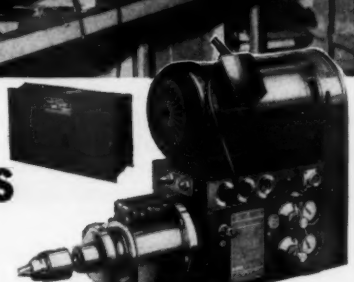
New Head Tried

In an attempt to solve it, a special automatic drill unit, with all operating and control mechanisms built-in, was set in place of the standard head on the drill press regularly used for this work. A cycle timer and unloading chute were added to complete the new set-up. Note the special mounting bracket, an accessory supplied by the manufacturer, used to secure the new drill head to the standard drill press column. Because more accurately controlled precision feeds and speeds are possible with this new drill head, these remarkable new production results were achieved:

1—no drill breakage
2—333 pieces per hour—
2½ times former production
3—lower unit cost

This unique drill head is a completely new and different production tool. It is the Dumore Automatic Drill Head, Series 24, designed for single or multiple unit operations where versatility and flexibility are necessary to meet the varying conditions and frequent changeovers of diversified manufacturing. In this case, it proved its worth on one set-up. When desired, it can be moved quickly and easily to numerous other operations with minimum time loss. For further information about this and other automatic precision tools for greater production possibilities at lower cost, write to The Dumore Company, 1304 Seventeenth Street, Racine, Wisconsin. Adv.





PRODUCTION RUNS *doubled*

with this New 2-in-1 tool
the DUMORE Series 28 Automatic
"DRILL-N-TAP" UNIT

A large aircraft parts manufacturer uses a bank of 9 "Drill-N-Tap" Units, mounted on standard drill press columns, to get twice as much production per hour at lower cost, over hand methods. This combination set-up handles hundreds of small and large drilling and tapping operations daily. Drill brushings are simply removed when tapping. Tap fits into chuck, no extra head is required. *A flip of the switch controls tapping or drilling.*

This company also uses over 40 Dumore Series 24 Drill Units for all types of production drilling operations. They find that these automatic machines further help to cut costs and speed output all along the line.

A *driller* and a *tapper* . . . all in the same tool . . . at the cost of only one!

It drills or taps without attachments with less tool breakage and scrap losses. No long overhang, or expensive clutches to wear out. Self-reversing motor, electrically controlled, withdraws tap by reversing spindle rotation. Work mounts close to fixture with little tool travel for faster cycling, less idling time.

Mounts in 3 minutes —anywhere — with simple nose mounting bracket, on job after job for production runs in the high thousands or low hundreds. 10 speeds from 265 to 4900 rpm standard.

Available as complete Drilling and Tapping Press with fixture, press and "Drill-N-Tap" Unit, or, "Drill-N-Tap" Unit supplied with bracket to convert your 14" x 17" drill press into a completely automatic drilling and tapping machine.

GET A DEMONSTRATION NOW . . . SEE YOUR DISTRIBUTOR, OR WRITE

YOU CAN DO MORE WITH DUMORE DRILL UNITS
DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • CHAMFERING • DEBURRING

DUMORE PRECISION TOOLS

AUTOMATIC DRILL UNITS TOOL POST AND HAND GRINDERS

1304 Seventeenth Street, Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 161

MANUFACTURING MEMOS

Receives ASTE Research Medal . . .

● Hans Ernst, director of research for The Cincinnati Milling Machine Co., has been awarded the American Society of Tool Engineers' Research Medal. He was honored for significant published research leading to a better understanding of materials, facilities, principles, and operation, and their application to better manufacturing.

Recently Organized Firm . . .

● The newest entry in the field of vacuum melting, Vaculloy Corp. of Wooster, Ohio, has been formed by James H. Johnston and Edward R. Funk. The new firm is engaged in custom vacuum melting of titanium, steel, and other alloys for research, laboratory, and development purposes, using its own improvement of the consumable electrode double melting technique.

Expanded Research and Development Program . . .

● Associated Spring Corp. is expanding its research and development activities to improve its precision mechanical springs and spring steel, and to develop new products. A new research center is being established at the corporation's headquarters in Bristol, Conn., which will more than double research facilities and staff.

New Department Formed . . .

● An Ultrasonic Drilling and Grinding Department has been established by Zenith Optical Laboratory. Round and irregular shaped cavities are reproduced to precision tolerances in brittle and hard-to-machine materials.

Merger and Acquisitions . . .

● The merger of The Motch & Merryweather Machinery Co. of Cleveland and The Avey Drilling Machine Co. has been announced. The newly acquired Cincinnati firm will be known as the Avey Division, retaining its present facilities, management, and personnel. This company produces special transfer and indexing machines, and drilling, reaming, and tapping equipment. Motch & Merryweather has been a distributor for Avey for nearly fifty years.

● Pacific Precision Tool and Die Co. has been purchased by Zero Mfg. Co., a Burbank, Calif., metal fabricating firm. Pacific Precision is one of the largest tool and die shops in the San Fernando Valley.

● Rockwell Mfg. Co. has acquired Republic Flow Meters Co. of Chicago. Republic manufactures electronic and pneumatic instruments, and process control equipment.

Detroit Harvester Co. has bought the Danville, Ill., plant of F. L. Jacobs Co. This purchase is part of Detroit Harvester's program of diversification and expansion.

◆

All manufacturing and sales rights to the machine tool clamping and setup system produced by Techno Products Inc. has been acquired by Universal Vise and Tool Co. of Parma, Mich. This product line is marketed under the name of "Q" Clamps.

◆

Pratt & Whitney Co., Inc. is cooperating closely with the National Bureau of Standards in Washington, D. C., to establish a means of accurately measuring one-tenth of a millionth of an inch. The company has assigned Albert M. Dexter, Jr., gage research director, to the project, which is being conducted under the direction of Dr. Irvine C. Gardner, chief of the Optics and Metrology Division of the Bureau.

◆

The appointment of Wallace E. Carroll as director of The Metalworking Equipment Division of the Business and Defense Services Administration, U. S. Department of Commerce, has been announced. Mr. Carroll, president and treasurer of American Gage & Machine Co., is on loan from his company and will serve for about six months.

◆

Firth Sterling, Inc. of Pittsburgh and Oregon Metallurgical Corp., Albany, Ore., have entered a joint agreement for the production and processing of titanium bars and forged rounds. Under the new arrangement, Firth Sterling will process titanium ingots produced by Oregon Metallurgical into mill products, which will be used in making support rings, compressor wheels, compressor blades, and other jet engine components.

◆

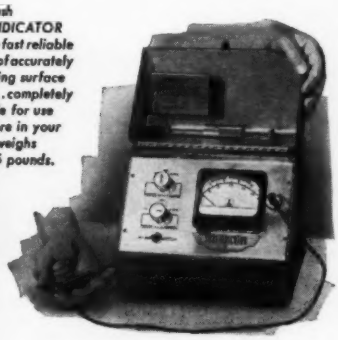
Four additional operating divisions have been created by Vickers Inc. as part of its continuing program of decentralization. They are the Machinery Hydraulics, the Aero Hydraulics, the Mobile Hydraulics, and the International Divisions. Each includes related groups of products and has its own engineering, manufacturing, marketing, and service facilities.

Can you afford to gamble on surface finish?

Today's more exacting quality standards have added a new dimension to every machined part. This dimension is *surface roughness* and it is now recognized as an important factor in machining costs. Yet, because of inaccurate measurement of this important new dimension, parts are often over finished and costs soar . . . or parts are under finished and product trouble develops.

Surface finish can be measured accurately

Unnecessary finishing expense can be prevented. A remarkable measuring instrument has been developed that permits *anyone* to make accurate surface finish measurements. Called the Brush SURFINDICATOR*, it permits checking of every finished or in-process surface in accordance with industrial and military specifications. The SURFINDICATOR can be operated without special training—a hand-held stylus is simply stroked over the surface to be measured and a direct reading taken in micro-inches. Completely portable, the SURFINDICATOR is designed for use where it's needed most—at the machine. Extremely accurate, it is the lowest cost method of finish control.



The Brush SURFINDICATOR offers a fast reliable means of accurately measuring surface finish . . . completely portable for use anywhere in your plant, weighs only 15 pounds.

Precision Reference Specimens are provided with every instrument as a quick calibration check to permit field adjustment for absolute accuracy.

Full information on the cost-saving Brush SURFINDICATOR and ASA Standards contained in descriptive booklet . . . new Brush Surface Finish Control Efficiency Study can help evaluate surface finishing.

The complete story on how surface finishing costs can be controlled is contained in our booklet describing the Brush SURFINDICATOR. To help you in evaluating over and under finishing in your plant, a Surface Finish Control Study form is also available. Write for both—they can provide you with a new insight to the cost savings possible through accurate surface finish control.

*T. M.

BRUSH ELECTRONICS COMPANY

3500 Perkins Avenue, Cleveland 14, Ohio

BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

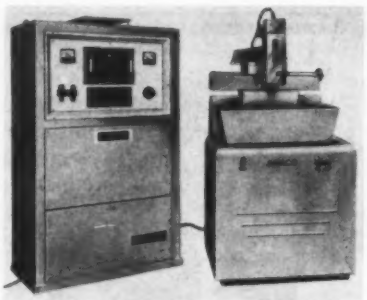
CIRCLE INFORM-A-GRAM KEY NO. 163

MACHINING HARD METAL BY SPARK EROSION

Spark erosion permits the machining of metal no matter how hard. Improvement in this machining method, however, has been so rapid that it is difficult to keep pace with its progress.

In the spark erosion machine, manufactured by Abaco Industries, instead of using the current as a power source, it is used directly as the acting power to change the form of the workpiece. The MG-5 unit uses sparks to remove metal from already hardened material.

From 5 to 20,000 sparks are generated every second, each one removing a small amount of material at the point of impact. A soft copper electrode performs the job of the tool used in conventional machines and reproduces its shape exactly and to an accuracy of ±.0005 in the hard material. The electrode never touches the workpiece.

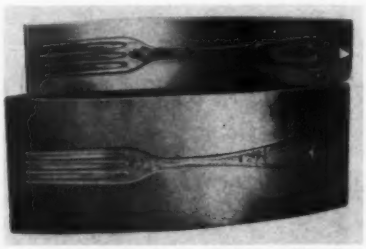


High frequency current generating unit with control panel is shown on the left. The machine tool with servo head controlled by a micrometer vernier depth gage is shown on right.

The process is conducted in a bath of oil to permit a buildup of electric resistance and a stronger spark. The new MG-5 unit works four times faster than former units because the high frequency current is generated right in the machine with a high efficiency motor generator. The current is rectified to pulsating DC and stored in a big battery of capacitor until released. This high density current can attain 300 amp average and 3,000 amp peak at electrode point. The new unit will remove as much as 0.050 cu in/min in refractory metal.

The electrode is under the constant control of a sensitive servo head which compensates at all times for the variation caused by metal removal. This servo head has a few new features, such as an automatic tripping device, which can be utilized when the machine is used at night on long duration jobs. The machine will run unattended for hours and will shut off automatically with the part ready for the morning shift. The servo also comprises an up and down movement of the quill by push-button control and forward release limit switch.

Due to the MG-5 wide spark gap at all machine settings, there is enough space for the chip to flow away and no forced coolant is necessary in the electrode. For this reason, the machine dimension of the workpiece can be unlimited. Due to special circuit, copper electrode wear is only 15% on roughing operations and 1% with tungsten copper on finishing operations. A solid electrode is used and no oil hole nor oil pressure is needed.



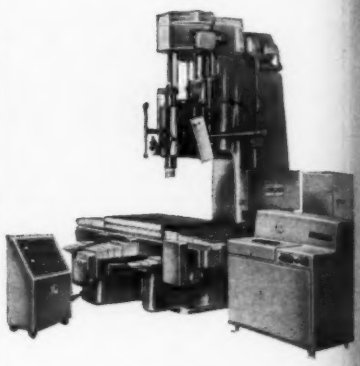
A die made for a fork machined on the above machine is shown: 6 concave electrodes were pressed in the die: 1 electrode for roughing; 1 for semi-finishing; 4 for finishing and super-finishing. Total time: 22½ hrs instead of 70 hrs by conventional methods.

Spark erosion is one of the few processes where finish and tolerance is independent of the operator's skill. By pushing a button, four different grades of finish from 80 to 10 microinch are chosen. This is set at the same time as machining tolerance from ±.005 to ±.0005. There is no physico-chemical modification of the workpiece since the tool never touches the work and no heat is generated.

WOODEN MODELS SPEED DEVELOPMENT OF MILLING CUTTERS

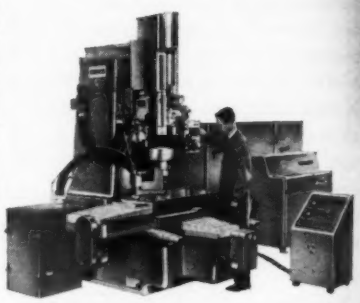
Wooden dummies of milling cutters aren't much good for actually cutting stainless steel, but they recently paid off for Goddard & Goddard's design and development engineers. When the Detroit milling cutter manufacturer was awarded a contract for thousands of dollars worth of special cutters for milling stainless steel turbine blades, their engineers decided to build wooden models for determining cutter performance. They decided upon blade arrangement and alignment, economical manufacturing methods, and the design most easily maintained and sharpened. The cutters finally made proved so successful, Goddard & Goddard reports, that their potential machining capabilities were far beyond the capacities of the machines themselves. They are made with chip breakers and staggered tooth design to ease the load on the machines.

PRATT & WHITNEY NUMERICAL CONTROL APPLICATIONS



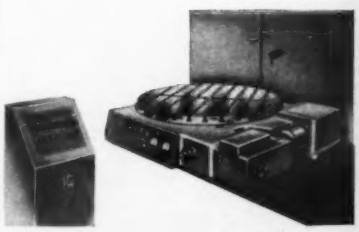
ELECTROLIMIT JIG BORER

Equipped with Numerical Control, the P&W No. 2E Jig Borer is equally suitable for toolroom and precision production applications. Settings accurate to .0001" are made automatically from data supplied by a punched tape or an operator's keyboard.



VERTICAL PRECISION HOLE GRINDER

Table and carriage are similar in design to the No. 2E Jig Borer and the same ultra-precision Electrolimit Measuring System is employed. Column, however, is equipped with interchangeable, turbine-driven grinding heads for spindle speeds to 100,000 rpm.



PRECISION ROTARY TABLES

These Pratt & Whitney Rotary Tables are the ultimate in precision and convenience for circular spacing, graduating and angular positioning. Settings accurate to 5 seconds of arc (2 seconds for repetitive settings) are made automatically from data supplied by punched tape or operator's keyboard.

PRATT & WHITNEY

CIRCLE INFORM-A-GRAM KEY NO. 165

TO "TENTHS" IN SECONDS

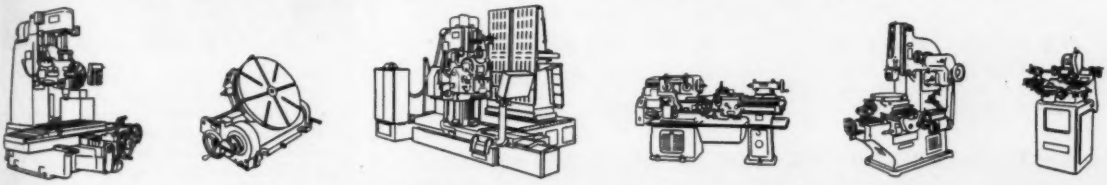
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned — accurate to .0001" — in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
15 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

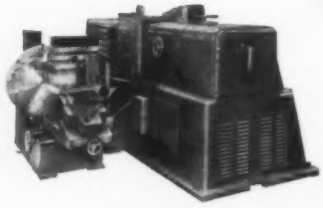
PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

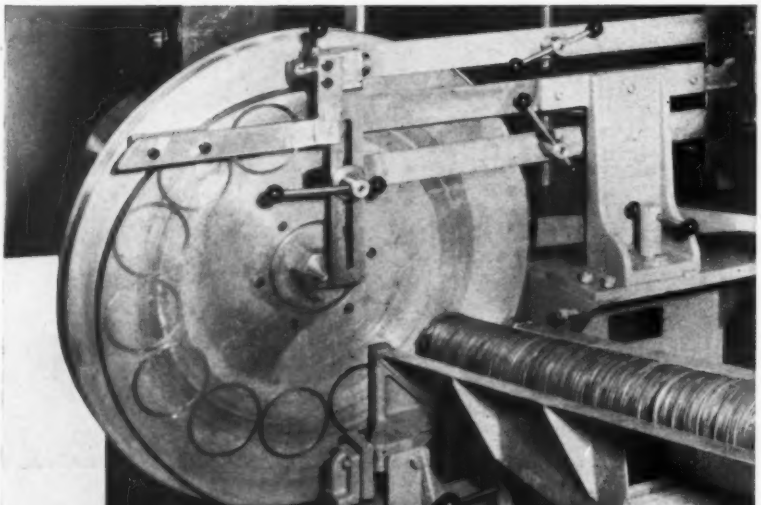
MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 165

MAGNA-LOCK magnetic ROTARY FEEDER



helps this disc grinder turn out six piston rings at each tick of the clock...

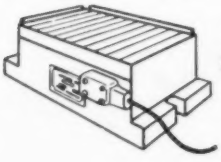


supplies continuous flow of pieces to the abrasive discs, permits full utilization of grinder's capacity

The Besly No. 240 Double Horizontal Spindle Grinder was developed to meet today's demands for ever increasing accuracy and speed. It's only natural that this machine incorporates automatic feeding—and only natural that a Magna-Lock electro-magnetic Rotary Feeder was selected.

Magna-Lock magnetic chucks and holding devices have solved many apparently unsolvable problems of holding, transferring and feeding. Perhaps Magna-Lock can solve *your* problem, too. Our engineers will be glad to work closely with you. Just write Dept. TP-57.

Request Magna-Lock as original equipment on your new mach...es.



Hanchett MAGNA-LOCK CORPORATION
BIG RAPIDS, MICHIGAN, U. S. A.
designers and makers of a complete line of magnetic chucks and devices.

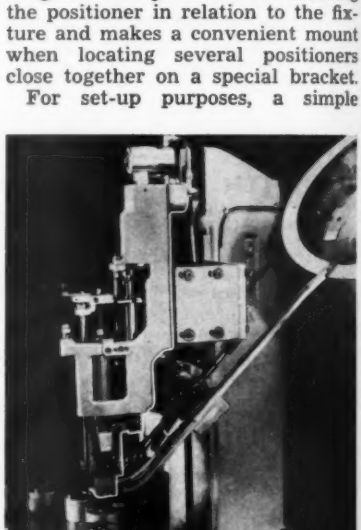
CIRCLE INFORM-A-GRAM KEY NO. 166

NEW STANDARDIZED UNIT AUTOMATICALLY POSITIONS WORKPIECES

A new standardized parts positioner recently developed is capable of accurately guiding a wide variety of piece parts automatically from feeder track to fixture. The new parts positioner, is a self-contained, standardized unit designed for widest possible application to reduce engineering and construction time to a minimum. The new unit handles parts ranging from 1/16" to 3" OD size at rates up to 7200 pcs/hr. It may be nested on 3" minimum centers along an in-line transfer table or may be located at adjacent stations on a 5" radius dial indexing table having as many as 12 stations.

These units, built by Dixon Automatic Tool, Inc., are designed with hardened alloy steel ram, bronze bushings, pilot controlled air valve, and a sturdy, semi-steel frame. Full electrical controls are included, with provisions for automatic interlocking. Air and electrical inlets are located for minimum interference with operation and adjustment. Exhaust valve adjustment for changing cycle speed is standard equipment. Base of the ram is engineered for mounting individually designed chuck jaws to suit varied requirements. Simple T-bolt mounting arrangement is provided for locating the positioner in relation to the fixture and makes a convenient mount when locating several positioners close together on a special bracket.

For set-up purposes, a simple



The setup illustrated is used for assembling clock-winding key bows accurately into slotted stems. Stems are positioned and oriented in preceding station, and, at a subsequent station, a staking operation is employed to secure the two parts together. The Model PR-3 parts positioner, as shown, is mounted on a standard Dixon machine structure. A standard Dixon parts escapement unit automatically controls the feed of parts to positioner and indexing table.

hand-operated pop-up valve is included to initiate the cycle, making it easy to check adjustment and performance without indexing work fixtures or manipulating remote circuit. In actual operation, the positioner serves as an efficient sensing device. If a part is missing or improperly placed, the machine stops automatically with ram in forward position making it a simple matter to find which head failed to perform its proper function.

The timing is such that the positioning punch may advance far enough to control the work in the placement chucks. From this point, the positioning punch and chucks move together controlling the part without gravity assistance. The chucks stop at the proper level above the fixture and automatically open while the positioning punch continues its advance to place the piece. The cam that opens the chuck can be easily adjusted to release the part at the exact moment it is carried forward by the positioning punch.

The new Dixon positioner offers the economies of standardization with easy changing to meet varied requirements. Necessary tooling, electrical and mounting work are extremely simple. No extra limit switches are required since the positioner is a completely automatic cycling mechanism. Addition of a small double pole, double throw relay in the control circuit, and providing an electrical signal to indicate that the work fixture is in place, are all that are needed for electrical adaptation to individual needs.

HOLES DRILLED LAST FOR CONCENTRICITY

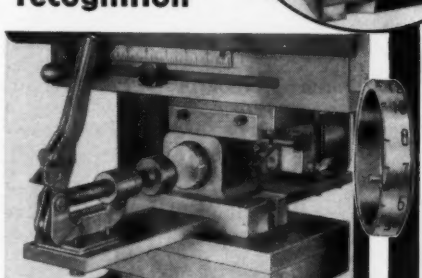
The farm tractor part shown below is being made on an experimental basis by using a Starbore drill with a Carmet CA-4 carbide tip. Time can be saved if the hole is drilled last instead of first as is usually done. The hole is 0.430" dia x 4¼" long in a cast iron valve stem bushing, and is made in 4¼ sec. The hole is held to a 0.0005" tolerance on the diameter and a 0.002" concentricity tolerance. Surface finish of the hole, which is honed later, is 50 micro-inch, rms. Drill speed is 3,000 rpm, coolant pressure 250 psi. Sulphur-based oil is the coolant used.

MARK *Your* PRODUCT FOR *More Sales!*

for identity, for product recognition

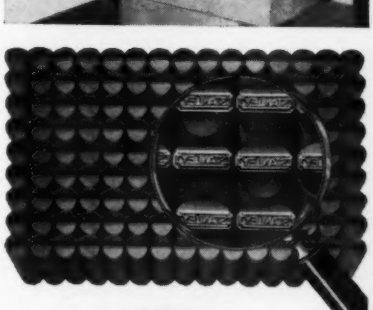
BY HAND...

handstamp trade marks, legends on short run components.



BY MACHINE...

automation in marking on production runs, manually, hydraulically or by air.



BY PRESS...

for metal, wood or plastic products with standard or special marking dies.

BY HOT STAMPING...

for indenting softer materials or stamping gold leaf or foil into plastic, leather, etc.

BY PRINTING...

on virtually any surface with flat, concave, convex or roll printing dies.

Send for folders and descriptive literature on Parker marking tools and machinery.

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THE PARKER-HARTFORD CORPORATION by Parker

MARKING DIE & MACHINERY DIV.

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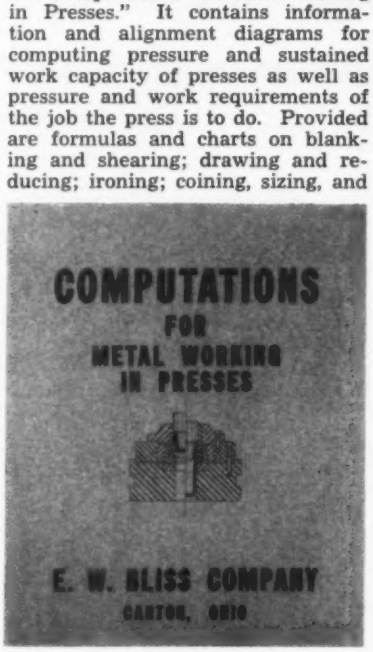
CIRCLE INFORM-A-GRAM KEY NO. 167

SHOP AIDS

Data on Metalworking is presented in "Computations for Metalworking in Presses." It contains information and alignment diagrams for computing pressure and sustained work capacity of presses as well as pressure and work requirements of the job the press is to do. Provided are formulas and charts on blanking and shearing; drawing and reducing; ironing; coining, sizing, and



forging; and extrusion. One section aids in selecting the proper press and discusses the factors to be considered. Also given are tables on the properties of metals, sheet metal, and wire gauges, and approximate diameters of blanks for shells. For your copy of Bulletin 38, write to E. W. Bliss Co., 1375 Raff Rd., S.W., Canton, O., or — **Circle No. C1.**

Tips on How to Obtain Longer V-Belt Life are contained in Bulletin 20X6234C from Allis-Chalmers Mfg. Co., Milwaukee 1. The 12-page bulletin describes the various types of V-belts and tells how to select and match them. Listed are seven steps for the correct installation of belts. Also shown are the eight most common causes of V-belt destruction.
Circle Inform-A-Gram No. C2.

A Data Folder for Special Alloys and Fluxes serves as a buyers guide for supplies needed in the welding, brazing, soldering, cutting and tinning of metals. All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y., will supply copies of the folder presenting the company's complete line, or —
Circle Inform-A-Gram No. C3.

A Notebook on 17-4 PH Precipitation Hardening Stainless Steel has been released by Electric Steel Foundry Co., 2141 N.W. 25th Ave., Portland 10, Ore. It presents the first phase of a study in establishing mechanical properties after various heat treatments. Included are a compilation of mechanical properties after precipitation hardening at temperatures of from 800°F to 1200°F in 50° steps for both cast and wrought samples. Also noted are the various mechanical properties of 17-4 PH in the as-cast and annealed conditions.
Circle Inform-A-Gram No. C4.

A Tracing Template covering over 200 components for jigs and fixtures in full scale is now available from Northwestern Tool & Engineering Co., 116 Hollier Ave., Dayton 3, O. Included are V-pads, T-slot nuts, hand knobs, fixture keys, knurled head and shoulder screws, and latch bolts. Also presented are toggle shoe clamps, jig feet, quarter turn screws, flanged nuts, and spherical washers. These standard templates are designed to save time. Get your copy from the company, or —
Circle Inform-A-Gram No. C5.

A Directory of Special Tooling Services has been issued by National Tool and Die Manufacturers Assoc., 908 Public Square Bldg., Cleveland 13. The 68-page pocket-size directory lists approximately 1,000 contract tool and die plants throughout the United States and Canada. Information given includes company name, address and telephone number; names of individuals to contact; and the specific products and services offered by each.
Circle Inform-A-Gram No. C6.

A Wall Chart of Conversion Factors has been published by Precision Equipment Co., 3716 N. Milwaukee Ave., Chicago 41. Included are common conversions such as inches to centimeters or watts to horsepower, as well as many conversions that are difficult to locate in reference manuals. Engineers and shop men will find the chart very useful. Obtain your copy from the company, or —
Circle Inform-A-Gram No. C7.

A Hand Lift Truck Booklet is now available from the Assoc. of Lift Truck and Portable Elevator Manufacturers, Suite 759, 1 Gateway Center, Pittsburgh 22. It covers the selection and use of mechanical and hydraulic hand lift trucks. Included are schematic diagrams of how the single- and multi-stroke mechanical, and the hydraulic hand lift trucks operate. Request copies of the booklet from the Association, or —
Circle Inform-A-Gram No. C8.

A Hydraulic Oil Data and Lubrication Guide as related to hydraulic presses is now being offered by Lake Erie Machinery Corp., 706 Woodward Ave., Buffalo 17, N. Y. It deals with the supervision of hydraulic systems, preventive maintenance, oil specifications, and guide lubrication. Also included are general remarks covering hydraulic press operation and special lubrication considerations. Copies are illustrated Bulletin 155 are provided by the company, or —
Circle Inform-A-Gram No. C9.

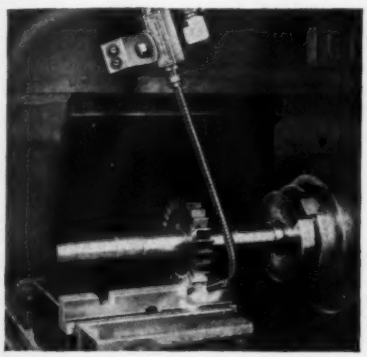
Ordinary Slide Rule Computations and the solution of any formula, special to a business, involving two variables, raised to any power or root, and a constant are performed by the Graham Handy Horsepower Computer for variable speed drives. Logarithms are put to work differently from the slide rule. There are no coordinate rulings, so that the chart has few lines and is easy to

read. The function of coordinate lines is performed by two superimposed sliders with hairline. On the back of the computer are given useful formulas, engineering constants, and decimal equivalents. Copies of the computer and the booklet, "Fascination in Numbers," are issued by Graham Transmissions, Inc., Menomonee Falls, Wis., or —
Circle Inform-A-Gram No. C10.

MIST COOLING MEANS LONGER TOOL LIFE

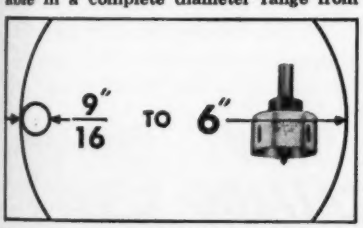
Recent reports by metal cutting specialists indicate that mist cooling produces important benefits in longer tool life, improved work quality and reduced heat distortion of work on a wide variety of operations. Mist cooling systems like the MILFORD Atom-Lube combine compressed air and cutting fluid, producing a fine mist to remove heat from the tool's cutting edge and from the work. This is the major factor in improved tool performance.

The MILFORD Atom-Lube system is a ruggedly designed unit made specially for tough industrial applications. Adaptable to almost any piece of equipment, its range of applications is only limited by the industrial user's imagination. For more complete information about making these savings available for your operations, write to MILFORD . . . a pioneer in mist cooling.

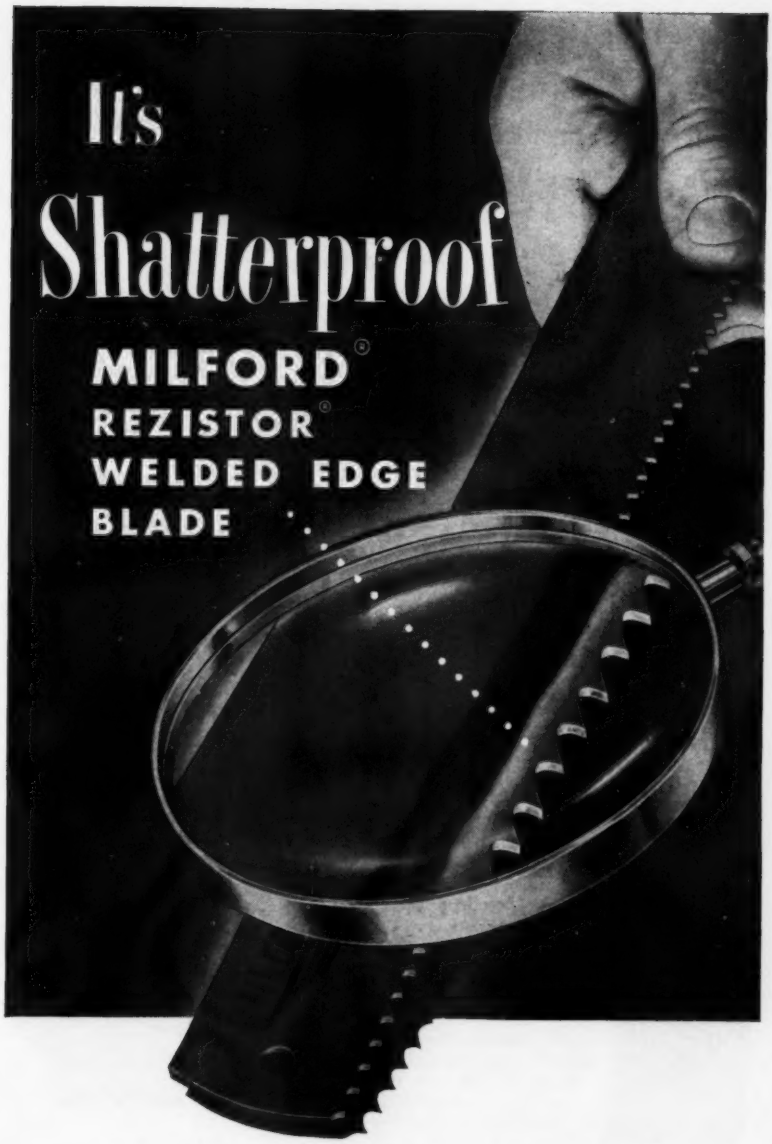


MILFORD Distributors now offering Hole Saw Line

Industrial distributors who carry MILFORD Hack and Band Saw Blades are now stocking the new MILFORD Shatterproof High Speed Steel Hole Saws. Available in a complete diameter range from



9/16" to 6", these welded-edge blades cut clean, round holes in practically any machinable metal or non-metallic. Many manufacturers have investigated their present hole cutting methods, particularly in large diameters, and after comparative tests have selected MILFORD Hole Saws. A new convenience for industrial maintenance work are MILFORD's sturdy metal Hole Saw Kits for popular pipe tap sizes and pipe entrance sizes. Local MILFORD distributors are ready to demonstrate these plumbers' and electricians' Hole Saw Kits, as well as other MILFORD metal cutting saws, to industrial customers throughout the country.



Industry's first choice in *Shatterproof Power Hack Saw Blades,* the REZISTOR WELDED EDGE combines the maximum in safety and metal cutting performance. Three-ply construction provides a cutting edge of high speed steel with teeth as hard, sharp and long-wearing as any all-hard blade . . . and this edge is *WELDED* and *HOT ROLLED* into a back of tough resilient alloy for superior strength and shatterproof qualities.

MILFORD

BUY FROM YOUR MILFORD DISTRIBUTOR . . . a local businessman who stocks the tools and equipment you need. You'll SAVE TIME, CUT BUYING COSTS and REDUCE INVENTORIES.

THE HENRY G. THOMPSON & SON COMPANY • NEW HAVEN 5, CONNECTICUT

Saw Blade Specialists for Over 80 Years

HACK SAW AND BAND SAW BLADES • HOLE SAWS • GROUND FLAT STOCK

CIRCLE INFORM-A-GRAM KEY NO. 169

NOBLE & STANTON *Standards* FINEST QUALITY

JIG and FIXTURE COMPONENTS

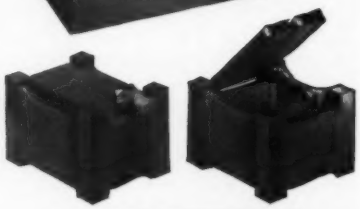
Complete Line—Over 500 Parts

"T" ANGLE PLATES

Fixtures in a Jiffy!

Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized and precision machine castings. Full scale sheets of 7 standard sizes will be included with your catalog if requested.

BOX JIGS



Box Jigs shown are made in either square or rectangular style in 9 sizes. Have them on hand in several sizes, use them, and watch your profits mount.

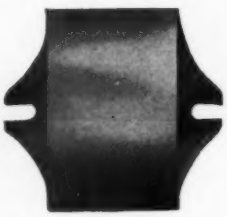
MILL FIXTURE BASES

The Mill Fixture Base shown on top is available in four sizes, the Gang Mill Fixture Base in three. Both are furnished with either standard keyways or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost. These normalized bases are precision ground, parallel top and bottom with one side finished parallel to the keyways, eliminating the delay and expense necessary in obtaining patterns, castings, normalizing and machining. Ask for full scale template drawings in your size range.

Sure Lock Fixture Keys See Page 41 of our Template Catalog

WRITE FOR FREE CATALOG

Our complete line of highest quality jig and fixture parts is shown in our new catalog. They are stocked for quick delivery from Dealers coast-to-coast. Write for your copy today!



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MANUFACTURERS OF GENUINE NOBLE & STANTON PARTS
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SPECIAL PRECISION PARTS

IN QUANTITIES—AT REASONABLE PRICES

Do you need special interchangeable tool parts, precision-made to your specifications, in quantities from 6 to 100 pieces or more? The automotive and aircraft industries have used us for years for this type of work. At present a number of large automated plants depend upon us for special, precision-made parts at reasonable prices. We are especially qualified to meet your automation parts requirements. Our prices, quality and delivery will more than please you. Send your prints for prompt quotations.

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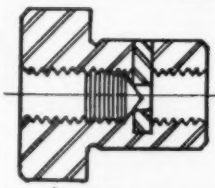
Standard
JIG & FIXTURE COMPONENTS

Just a Few of the Many

NEW ITEMS

in our Line of 500 Components



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DOUBLE CAM LEVERS

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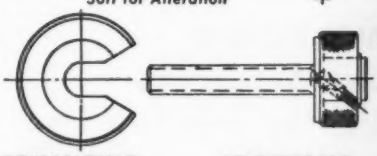

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4	23	42	61	120	143	186	193	230	1184	1781	1881	2033	2114	2234	2323	2431	2515
5	24	43	62	121	144	187	194	233	1185	1782	1882	2034	2151	2241	2324	2432	2551
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8	27	46	65	125	150	172	201	238	1371	1812	1952	2042	2161	2244	2353	2442	2571
9	28	47	66	126	151	173	202	241	1372	1813	1953	2043	2162	2245	2361	2443	2572
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13	32	51	70	131	155	179	210	249	1701	1823	1963	2074	2192	2281	2365	2473	
14	33	52	71	132	156	180	214	250	1702	1851	1991	2081	2193	2282	2391	2474	
15	34	53	75	133	157	183	217	253	1703	1852	1992	2082	2201	2283	2392	2481	
16	35	55	76	135	158	184	218	258	1771	1853	2001	2083	2202	2284	2393	2482	
17	36	56	109	138	159	187	221	259	1772	1854	2002	2084	2203	2311	2394	2483	
18	37	57	113	138A	160	189	222	260	1773	1861	2003	2085	2204	2312	2401	2511	
19	38	58	115	139	161	190	225	1181	1774	1862	2004	2111	2231	2313	2402	2512	

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A1	A19	A37	A55	A73	A91	B13	B31	B49	C4	E9
A2	A20	A38	A56	A74	A92	B14	B32	B50	C5	E10
A3	A21	A39	A57	A75	A93	B15	B33	B51	C6	
A4	A22	A40	A58	A76	A94	B16	B34	B52	C7	
A5	A23	A41	A59	A77	A95	B17	B35	B53	C8	
A6	A24	A42	A60	A78	A96	B18	B36	B54	C9	
A7	A25	A43	A61	A79	B1	B19	B37	B55	C10	
A8	A26	A44	A62	A80	B2	B20	B38	B56	D1	
A9	A27	A45	A63	A81	B3	B21	B39	B57	D2	
A10	A28	A46	A64	A82	B4	B22	B40	B58	D3	
A11	A29	A47	A65	A83	B5	B23	B41	B59	E1	
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A14	A32	A50	A68	A86	B8	B26	B44	B62	E4	
A15	A33	A51	A69	A87	B9	B27	B45	B63	E5	
A16	A34	A52	A70	A88	B10	B28	B46	C1	E6	
A17	A35	A53	A71	A89	B11	B29	B47	C2	E7	
A18	A36	A54	A72	A90	B12	B30	B48	C3	E8	

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THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

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A10	A28	A46	A64	A82	B4	B22	B40	B58	D3	
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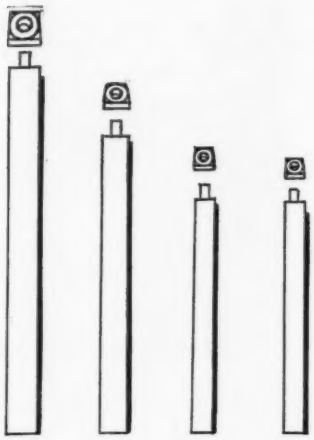
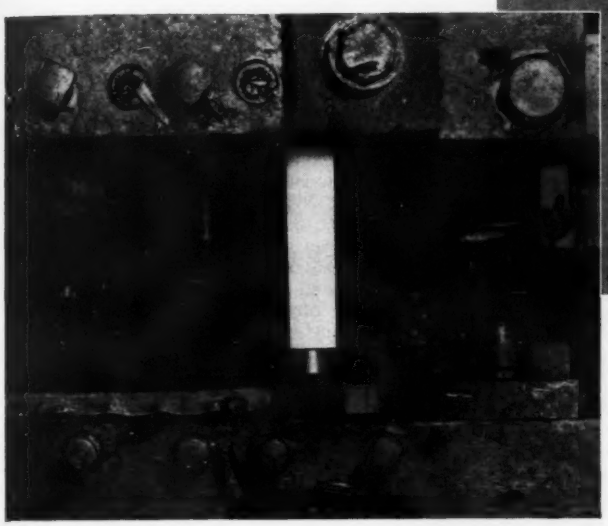


A-L CUSTOMER FINDS SAGAMORE PUNCHES BEST IN TOOL-COST STUDY



Looking down on the SAGAMORE high speed cold nut punch in horizontal press.

An A-L customer tested various tool steels to determine the best for his varied cold-punching operations. SAGAMORE, a new air-hardening, non-deforming die steel was the ultimate choice. Here's why:

- Using SAGAMORE cold-drawn stock eliminated the need for finish-grinding the punches.
- Punches of SAGAMORE outperformed those of carbon-vanadium steel three to one.

The SAGAMORE punches were hardened by heating in a salt bath to 1750F. and air cooled. They were then given a double draw at 1110F. The resulting Rockwell hardness was 51C.

Characteristics of A-L SAGAMORE are: Excellent non-deforming properties, unusual toughness, lower hardening temperatures, and easier machining and grinding. These, plus the comparatively low cost, make it a good selection for this type of application.

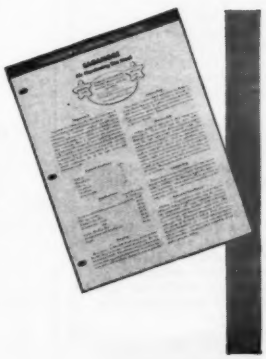
For assistance with your tool or die steel problems, call your local A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For nearest representative, consult Yellow Section of your telephone book.

Write for your SAGAMORE BLUE SHEET

This four page report was compiled from data collected in laboratory and field tests. Included is complete information on applications, physical characteristics, forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. TP-89



For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

CIRCLE INFORM-A-GRAM KEY NO. 171

THROW-AWAY CARBIDE INSERTS REDUCE TOOL COSTS ABOUT 5-TO-1

One of the most carefully-controlled tests of throw-away carbide insert tools to evaluate their performance was recently conducted by The Hyster Co. The results showed that Kendex tooling reduced tool costs to about one-fifth of that recorded for brazed tools, using the same Kennametal Grade K21 in both brazed and Kendex tools.

Additional savings were obtained from greatly reduced downtime for changing tools because the Kendex inserts could be indexed accurately in seconds.

The tests consisted of turning, facing, and chamfering a 13" dia, ¾" steel plate on which a 5⅜" dia seamless steel tube is welded to make a carrier-trunnion.

The average number of pieces per insert turned to 12¾" dia and chamfered was 242.4, or 30.3/cutting edge, using Kendex Style KSDR-85 square turn-over inserts. This compared with 88 pcs/brazed-tip tool with 9 regrinds.

Kendex tool cost per piece was 1.6¢ as compared with a brazed-tip tool cost of 7.4¢/pc. Kendex insert and

chip breaker cost $2.88 plus $1.05 (one-tenth of the holder cost) for a total of $3.93. Brazed tools cost $6.49 of which $3.24 was for 9 regrinds.

The plate was faced to a 12" and a 8" dia with a Kendex Style KTFR triangular insert tool. The average number of pieces faced per insert was 280.2 or 46.7/cutting edge. This compared with 126.4 pcs/brazed-tip tool with 7 regrinds.

Kendex tool cost was 1.26¢/pc as compared with a brazed tip tool cost of 6.6¢/pc. The Kendex insert and chip breaker cost $2.49. This plus $1.05 (one-tenth of the holder cost) gives a total tool cost of $3.54. Brazed tools cost $8.40 of which $4.73 was for 7 regrinds.

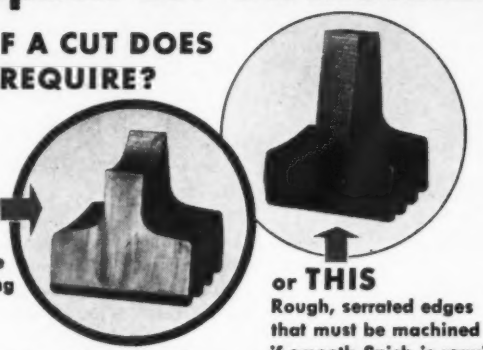
The machining was done on a Warner & Swasey No. 2 lathe with the following feeds, speeds, and depth of cut:

	TURN	FACE
Feed	.0054"	.013"
RPM	134	134
SFPM	455 max.	455 max.
Depth of Cut	3/16"	1/4"

Abrasive Cutting | *the best way to cut many materials* *the only way to cut some*

Campbell Cut-Off Machines

WHAT KIND OF A CUT DOES YOUR JOB REQUIRE?



THIS
Clean, smooth edges that require no further finishing

or THIS
Rough, serrated edges that must be machined if smooth finish is required

• The smooth cross section of gear teeth, shown above, is cut smooth, fine-finished and ready for metallurgical study. Made on a CAMPBELL Wet Abrasive Cut-Off Machine —and the ALLISON Abrasive Wheel just right for the job—it saves a grinding operation at a Midwest gear plant.

Another CAMPBELL Cut-Off Machine cuts stainless steel tube twice as fast as other methods for a large aircraft manufacturer. Another cuts tough K Monel, 3¾" dia., in two minutes per cut.

These are but a few examples of the wide variety of materials and sizes which can be cut better—and *faster*—with CAMPBELL Cut-Off Machines. Let our abrasive cutting specialists check your cutting operation. It can save time and money.

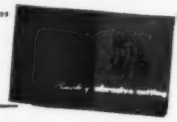
There is a CAMPBELL machine to handle all sizes

Model 2 • hand-operated submerged cutting machine with 4" dia. capacity.
Model 15 • hand-operated wet or dry machine. Max. capacity 1" dia. solid, 2" tubing.
Model 223 • hand-operated bar cutting machine. Cap. 2" dia. solid, 4" tubing.
Model 265 • hydraulically-operated with capacity to cut 2" dia. solid, 4" tubing.
Model 302 • horizontal wet abrasive cutting machine for flat or irregular shapes.
Model 406 • high speed machine with capacity to cut 6" dia. solids in seconds.
Model 476 • fully automatic wet abrasive cutting machine with capacity to cut 6" dia. solids.
Model 481 • for wet abrasive cutting of stock up to 8" solids.
Model 509 • rotary oscillating hydraulic wet abrasive machine. Cuts material to 9" dia.

ACCO

Ask for this Book
"PRINCIPLES OF ABRASIVE CUTTING"

Campbell Machine Division
AMERICAN CHAIN & CABLE
927 Connecticut Avenue, Bridgeport 2, Connecticut



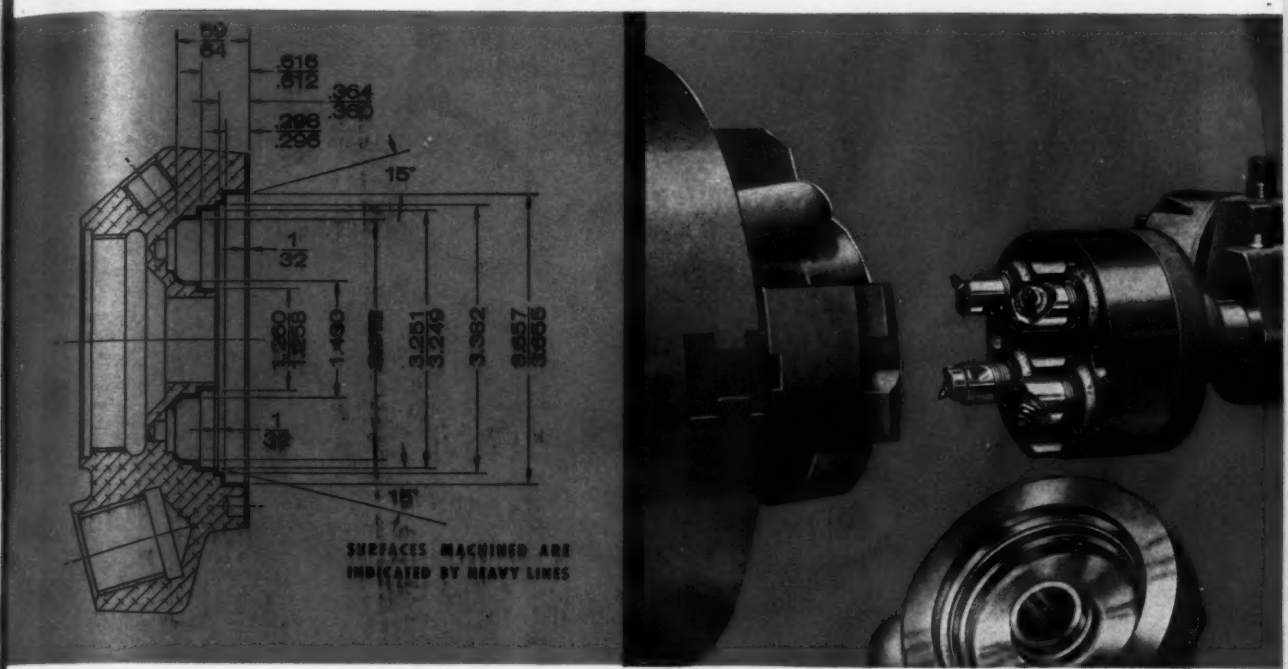
CIRCLE INFORM-A-GRAM KEY NO. 172

AUTOMATIC GAGE AND TRANSFER MACHINE CULLS SPOILED PARTS

One of the elements in a new engine block transfer line designed for a leading automobile manufacturer by The Ingersoll Milling Machine Company, is a large gaging station for checking 5 crankshaft bores and 5 camshaft bores in the engine block.

The gaging elements and classifying equipment were supplied by Federal Products Corporation, while the handling, positioning, and control portion of the machine was made by Ingersoll. This setup not only checks the products of automatic machining, as do many automation

13 surfaces finish machined in 2 passes...



HERE'S HOW MICROBORE CLUSTER TOOLING DOES IT ON A TURRET LATHE!

This Special Microbore Production Tooling was designed for a well known hydraulic pump manufacturer to machine pump covers on a turret lathe. Operations include precision boring and turning thirteen diameters and faces in only two passes. Think of the costly manhours saved and down time eliminated in comparison with conventional, piecemeal methods of handling this same job.

ACCURACY IS AN ECONOMY—With the Microbore System of cluster tooling, independent precision adjustment of each Microbore tool point permits accurate settings in a matter of seconds. On piece after piece, machined surfaces are held to extremely fine limits.

Microbore is a versatile tool that can be applied singly or in clusters for all types of boring, turning and facing operations. Microbore also manufactures Standard Boring Bars, Boring Bar Sets and Microbore Flash-Change Tooling—the ultimate for quick change tooling.

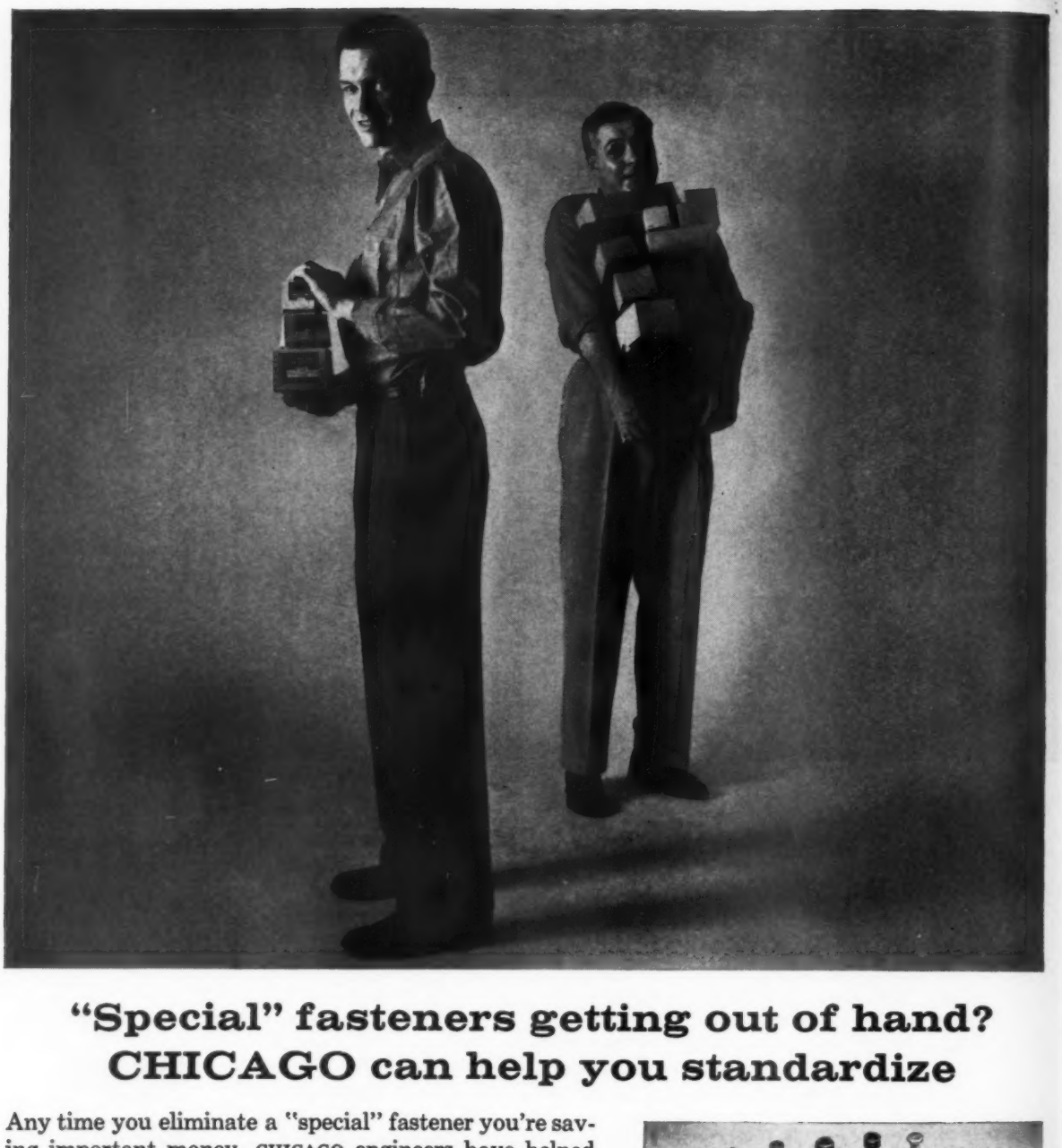
Join the leaders who are already multiplying their profits with modern Microbore tooling and methods. Write for Catalog No. 56.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 173



"Special" fasteners getting out of hand? CHICAGO can help you standardize

Any time you eliminate a "special" fastener you're saving important money. CHICAGO engineers have helped many firms cut costs by designing for *standard* fasteners . . . probably we can do the same for you.

The CHICAGO line is surprisingly complete—more than 4,000 standard products always in stock. So there's a good chance that we make anything you're likely to need in an industrial fastener.

For help with all your fastener problems, the man to see is your CHICAGO distributor. Through him you get the full benefit of our 85 years experience . . . exclusively in fasteners.

THE CHICAGO SCREW COMPANY

DIVISION OF STANDARD SCREW COMPANY • ESTABLISHED 1872

2519 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

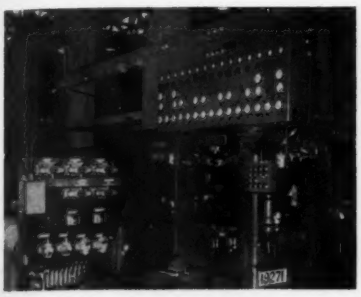
CIRCLE INFORM-A-GRAM KEY NO. 174

gages, but checks the result of an automatic assembly operation as well.

The air-electric gaging equipment is placed in the transfer line to inspect the engine blocks and to mark the acceptable ones to show their relative size. Blocks that are not acceptable are not allowed to continue to the next operation.

A total of 20 ID's — 2 each in 5 crankshaft bores and 2 each in 5 camshaft bores — are measured. In addition, the alignment of oil holes in the 5 bearing liners are checked for automatic assembly alignment with the oil holes in the camshaft bores.

All of these conditions are inspected simultaneously. The measuring is done with 10 air plugs



which are automatically inserted into the bores. Each of the plugs for the crankshaft bores takes 2 diameter measurements, i.e. at opposite ends of the bores and at right angles. The plugs for the camshaft bores make similar diameter measurements plus the oil hole location check.

Signal lights give a visual indication of the condition of the engine block. If all 20 diameters and the alignment of the oil holes are within tolerance, a green light indicates that the part is good. A stamping unit then stamps a plus or minus sign on each end of the block to indicate whether the No. 1 crankshaft and the No. 5 crankshaft bores are above or below the nominal size within the tolerance limits. If any one dimension is outside tolerance limits, the block is shunted out of the transfer line unstamped.

This combination automatic gage and transfer machine is capable of handling 95 engine blocks/hr. The short time necessary to make all 25 measurements does not slow down the production line, but allows the parts to move along at their normal speed.

Buy U. S. Savings Bonds — Today

HOT WORK STEEL DIES GIVE HIGH PRODUCTION AND LOW DOWNTIME

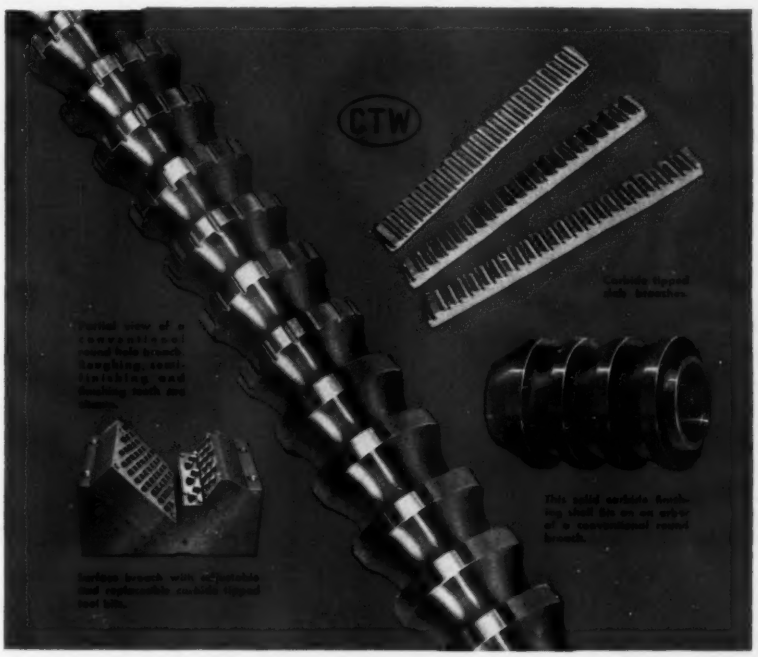
A hot work die steel is helping a Cleveland plant get more than a 330% increase in press forging one-use rock drill bits for use in coal and other mines, on highway construction, and in stone quarries.

Cleveland Rock Drill Plant, Le Roi Division of Westinghouse Air Brake Company, reported that the biggest advantage of using Allegheny Ludlum Steel Corporation's B-47 hot work steel for the die rings was the decrease in the number of breakdowns caused by die failure.

The B-47 steel is made into a die ring for the first of three presses which form the drill bit from steel bar stock. The stock is heated to 1950° F before press forging.

Since the company began using B-47 it has consistently been getting more than 10,000 drill bits/die ring with no downtime caused by die failure.

Allegheny Ludlum's B-47 is a tough hot work steel, which is made up of chromium, tungsten, cobalt, and vanadium, and has excellent resistance to shock and abrasion at elevated temperatures. It is especially good for applications which require ruggedness at relatively high hardnesses.



Why Continental Quality Broaches Actually Cost Less Than Ordinary Broaches

When you buy a broach, always consider the cost of work delays, scrapped parts, and time-consuming adjustments.

However, if the broach is free cutting, holds the required tolerances and finishes, with the maximum pieces per tool, chances are your original cost may be your *only* cost.

Because Continental effectively combines quality materials, skilled craftsmanship, and engineering experience, it is a fact: "these broaches cost less."

57-10

Continental
TOOL WORKS
Division of
Ex-Cell-O Corporation
Detroit 32, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 175

LARGE GRANITE SURFACE PLATE HAS FLATNESS TO 0.0002"

A large black granite surface plate, weighing 32 tons and measuring 12' x 12' x 2.5' thick, has recently been installed in the plant of McKeirnan-Terry Corporation.

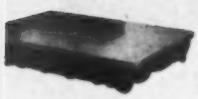
Optical instruments are unable to detect any variations in flatness in the central working area. At the edge it deviates from perfect flatness by only 0.0002".

This plate was designed for checking the preciseness of radar pedestals being manufactured for the government, but will find additional applications in McKiernan-Terry's design and manufacture of ordnance equipment, underwater sound equipment, and many other products.

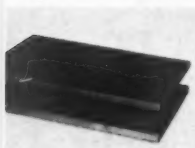
Granite was chosen for this application because it has superior stability, providing a smooth, nonraised surface despite small chips or holes resulting from continued use. Specified accuracy over the entire plate surface is thus assured for a number of years without refinishing. In addition, the granite is not abrasive to test instruments or the equipment being tested on its surface, and it is nonmagnetic. Being rustproof, the surface can be cleaned easily with water and any commercial detergent.

This plate was manufactured for McKiernan-Terry by the industrial division of Jones Bothers Company, and is commercially known as "Quardian".

This particular surface plate was shipped from Vermont by low-boy truck. And, as shipment was made during cold weather, it was necessary to allow the surface plate to soak for a two-week period under controlled temperature before it could be used as a reference plane.



Cast Iron Surface Plates
Sizes 8 x 10 to 48 x 144



Duplex Bench Block has twin working surfaces for wide utility whenever smooth flat surface is required.
Size 10" x 14" x 2⅜"

For Those NOT Satisfied with Slipshod Work!

Specify the superior accuracy of Taft-Peirce Granite Surface Plates

Your layout and inspection work deserves an uncompromising foundation for accuracy. Just one material and one type of surface plate will deliver this precision — a Taft-Peirce Granite Plate.

They feature .00005" per foot surface accuracy (4-ledge type), are more rigid, have a virtually indestructible surface. Taft-Peirce Granite Surface Plates are made of extremely fine-grained blue-white granite, with evenly distributed quartz and feldspar grains for extra long, hard wear. There is freedom from residual stresses, no distortion with temperature changes. Taft-Peirce precision grinding and lapping gives this fine granite the most accurate surface available to metal-working today.

Build *your* product on a foundation of true precision . . . write for complete information covering Taft-Peirce Surface Plates.

For everything in precision toolroom specialties

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, R. I.

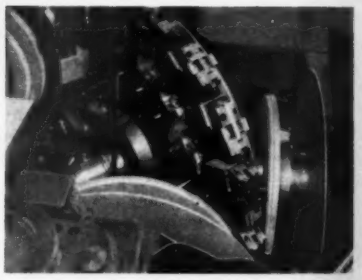
T-P Means TOP Precision

CIRCLE INFORM-A-GRAM KEY NO. 176

JET VANE GRINDER USES FOUR WHEELS AND THREE SPINDLES

A new three-slide grinder that automatically finishes the curved surfaces of jet engine vane roots, has been developed for large aircraft engine builders.

The machine, designed and built by the Ex-Cello-O Corporation, is equipped with four grinding wheels mounted on three spindles. Two of the spindles each carry a single wheel, while the third spindle carries two wheels. Dimensional tolerances are held consistently.



Each slide is equipped with an Ex-Cell-O cam-type universal diamond dresser, which shapes the respective wheels as part of the automatic machine cycle. The slides automatically compensate for the abrasive removed when the wheels are dressed. Slide movements include rapid approach, an adjustable fine feed, and adjustable spark-out period.

Two interchangeable trunnion fixtures are furnished with the machine to permit nearly continuous operation. While one fixture rotates the vanes through the grinding cycle, the second fixture is being loaded by the operator. Loading racks support the trunnions when these are out of the machine.

You Can Rely on a **ROUSSELLE**

THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

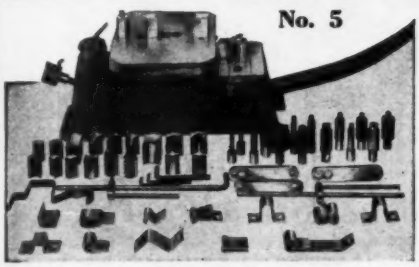
Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO. 2310 West 78th Street • Chicago 20, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1771



No. 5

WRITE FOR DESCRIPTIVE CIRCULAR

Multiform

BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛"x1½" as illustrated. Punching and round end blanking dies available. Other models up to ¼"x4" air operated.

ALSO AIR OPERATED MODELS

J. A. RICHARDS CO. KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1772

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303L North 11th St. • St. Louis 6, Mo.

CIRCLE INFORM-A-GRAM KEY NO. 1773

LIFTING DEVICES
for
FAST • SAFE • BETTER
Material Handling
of
• SHEETS
• COILS • BOXES
• MOLDS
• DRUMS • PALLETS
400 MODELS

Prompt Delivery
Write for full particulars

H. L. BUSHMAN CO. 100 West Central Ave. Roselle, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1774

DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD

Your business letterhead will bring literature.

WATTS BROS. TOOL WORKS
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1775

HOLD IT!

FIRMLY BUT GENTLY

WITH WOODWORTH CHUCKING EQUIPMENT

Our tough looking character who is holding the smiling baby clearly demonstrates one fact: whenever you are holding anything it should be secured with gentle firmness and this is so true when considering chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of N. A. Woodworth products. There is a Woodworth Sales Representative in your area and a letter to the N. A. Woodworth Company will place him promptly at your service.

"Accuracy you can trust"

WOODWORTH
1300 East Nine Mile Road
Detroit 20, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1776

This AIR PRESS has positive, exact depth stops

Many job changes can be made by quick, simple stop nuts, without touching column adjustment. Rigid, solid steel column, and heavy surface-ground base.

One of nine sizes and models in the great dependable Mead Air Press line.

Write for complete information!

MEAD SPECIALTIES COMPANY

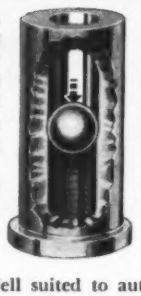
PATHFINDER IN AIR POWER AUTOMATION

4114 N. Knox Ave. Dept. HA-57 Chicago 41, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1781

Here's NEW Speed and Economy in HOLE SIZING and FINISHING!

BALLIZING is a high-speed, high-precision process for sizing and finishing holes — simply by pressing a suitably-oversize ball through the unfinished hole. It is used to advantage with holes from 1/16" to 5" diameter, in a wide range of metals—with production quantities from 1 piece to millions.



Rod (not shown) pushes ball through unfinished hole.

Precision ball of tungsten carbide, slightly larger than finished hole.

Hole before ballizing.

ADVANTAGES:

- FAST. Takes only seconds. Well suited to automation.
- ACCURATE. Produces uniform hole size.
- FINE FINISH — burnished smooth.
- ECONOMICAL. Replaces one or more machining, grinding or finishing operations. Uses unskilled labor. No tool sharpening. No close adjustments. No special or high-precision equipment required.

FREE BALLIZING BULLETIN gives details; shows typical applications. May we send you a copy?

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PRECISION BALLS OF ANY SIZE OR MATERIAL
ANTI-FRICTION BEARINGS FOR SPECIAL REQUIREMENTS
TOOLING BALLS — MASTER BALLS — SPHERICAL FINISHING

CIRCLE INFORM-A-GRAM KEY NO. 1782

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 1783

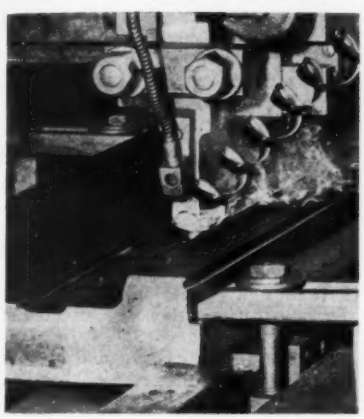
CARBIDE CUTTING POTENTIAL EXCEEDS PLANER CAPACITY

The rugged job of rough planing more than 2000 cu in of metal out of a solid piece of SAE 1035 steel to make a 113" long trough proved so successful with a heavy-duty tungsten carbide cutting tool that the full potential was found to be beyond the capacity of the planer and its 25-hp motor.

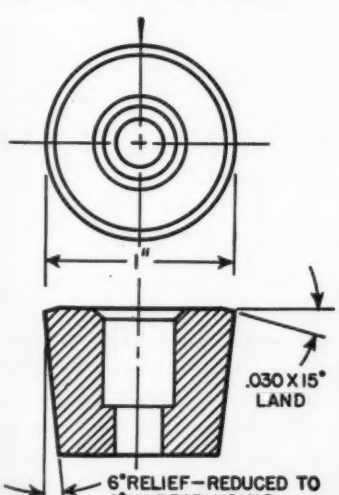
The operation, being performed at the Fischer Machine Company, has been running for more than 8 mos. with Kendex Style CDH 43 inserts, Grade K21, supplied by Kennametal Inc. With these inserts it was found possible to increase the feed to 0.07" in increments of 0.01"/stroke with a 0.25" depth of cut, but owing to machine vibration and overload on the motor the feed was backed off to 0.032". Running speed is 200 sfpm with 10 strokes/min. A Milford Atom-Lube mist coolant system with 80 lbs of air and 20:1 Cimcool was used.

A single Kendex insert removes a total of 183,000 cu in of steel from 80 pcs (3½" x 10" x 113") with nine regrinds. Each trough is 3" deep, 6¾" wide, and 113" long, leaving a channel with ½" web and 1⅝" thick flanges, and less than half the original weight of the bar.

Inspection of the round insert after the first two pieces were planed disclosed only about 0.010" top crater. The insert was then indexed or rotated to a new cutting edge. It is used in four positions 90° apart to plane eight pieces before regrinding. The insert is reconditioned by grinding on the top surface and on the circumference. The original 6° relief is reduced to 4° during regrinding, as shown in the line drawing. A 0.030" x 15° land is put on the cutting edge for this job.



In rough planing a 3" x 6¾" trough in SAE 1035 steel, heavy-duty Kendex inserts are used with a feed of 0.032"/stroke, 0.25" depth of cut, and speed of 200 sfpm.



The standard Kendex style CDH-43 insert was modified as shown for rough planing.

Talk to the people at

3P

It's a fast service company, staffed with personnel who know that "DOWN-TIME" is "LOST-TIME". Distributors in principle cities assure IMMEDIATE DELIVERY from over 37,000 sizes in stock.

You get the finest quality in 3P HEAD PUNCHES and DIE BUTTONS, because they are made from 3 types of the finest tool steel, and are available in any DECIMAL size.

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NEVER FEEL THE PINCH!
GET 3P PUNCHES AND DIE BUTTONS WHEN YOU NEED THEM.

"Still the best performer"

Porter Precision Products also make BAL-LOK* Punches and Die Buttons. They're always in stock and ready for IMMEDIATE DELIVERY too. Any DECIMAL size.

NO EXTRA CHARGE FOR FAST SERVICE HIGH QUALITY, OR ODD SIZES.

PORTER PRECISION PRODUCTS
PRinceton 1-6338 • P.O.Box 208 • Cincinnati 15, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 179

TEST REPORT ON SYNTHETIC COOLANT

A synthetic coolant has undergone a six week long series of tests at a large machine tool manufacturing plant. Test work has proven the coolant to have such outstanding properties that the test has now been expanded to include a cross section of all machining operations on all metals throughout the entire plant.

In each instance the coolant, made by Daubert Chemical Company, was placed on a trouble job — one where the desired finish could not be obtained, where tool life was excessively short, where sufficiently close tolerances could not be held, or where corrosion problems were causing a high percentage of rejects. These problems were encountered on regular cylindrical grinders, submarine grinders, Warner-Swasey turret lathes, and Bardons & Oliver turret lathes, all using competitive products.

In all grinding operations where Daubert coolant was tested, a superior finish was obtained and residual rust prevention was given to the parts. For example, in a cylindrical grinder using a conventional grinding solution (1-50 dilution) the parts would rust overnight. In the same operation, using Daubert synthetic coolant at the same dilution, parts were rust-free one week later.

One test involved a part machined from an AMS 5610 steel which is a high grade stainless steel. The base rate for the job was 4-2/3 pcs/hr with 6 pcs/hr being 100% bonus. In the several weeks this job had been running, the operator, who was the best machinist in the division, had not quite been able to make his base rate because of excessive tool change. He was losing 32 min out of every 120 min due to tool change. After putting in Daubert's synthetic coolant, he was able to do better than 6 pcs/hr from the first piece right on through the job, which lasted about four more weeks. His tool changes per 8-hr day were cut from 17 to 6-7. In addition, he was able to increase the machine speed approximately 25% and to produce a far superior finish.

Another test on a different machine with a different operator concerned an AMS 5630 steel part on which the finish was very critical. This operator was able to increase his machine speed from 546 rpm to 927 rpm by using Daubert coolant. A reduction in tool changes from 11 per day to 8 per day was effected at the same time.

An aluminum casting had to have about 30% of the original casting removed in two drillings and a facing operation. In this case an excellent finish was imperative and size or tolerance of lesser importance. Previously, water solubles, both oil and synthetics, would not produce an acceptable finish. Petroleum cutting oil gave a borderline finish, but the part was so hot that it would burn the operator's fingers when removing it from the chuck and when checking dimensions. Using Daubert's coolant, the part did not even warm up and the finish was much better than required.

The Nylok Corp. has licensed Lamson & Sessions Co. of Cleveland, Ohio, to produce its patented line of self-locking screws and bolts. The process involves inserting a nylon plug into a hole drilled in the threaded end of the fastener. Lamson & Sessions is the eighth domestic company licensed.

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COST CUTTING TOOLS

3/8" - 7/16" - 1/2" and 5/8"

THIN SLOTTING CUTTERS

4" — 5" — 6" — 8" — 10" and 12" in diameter

with Jack-Lock® Blade Locking Wedges

• Designed specially for milling thin slots accurately and efficiently. Jack-Lock wedges extend the full width of the body. Consequently, locking pressure is applied parallel to the sides of the body, assuring true running at all times. Cutting faces of the blades are milled and ground to provide the axial rakes required. Easily converted to a half-side mill by simply inserting blades all of one hand. Extra large hubs provide added ruggedness and rigidity. Easily mounted on a grinding arbor for resharpening. Unsurpassed performance. Write for a bulletin today!

The complete McCrosky line includes:

Jack-Lock® Milling Cutters Wizard® Quick-Change Chucks
Super® Adjustable Reamers Block Type Boring Bars
Turret Tool Posts Specially Engineered Multiple Operation Tools

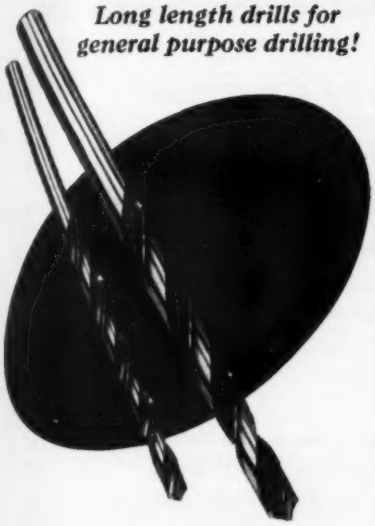
Fully descriptive catalogs sent promptly on request. Write for yours today!

COST CUTTING TOOLS McCROSKY TOOL CORPORATION
MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

CIRCLE INFORM-A-GRAM KEY NO. 180

Long length drills for general purpose drilling!



ACE

TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

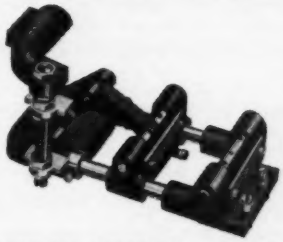
NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

CIRCLE INFORM-A-GRAM KEY NO. 1811

A SURE FEED



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Your pressroom can produce more with this compact, durable stock feed. Can be mounted right on die set to save you time. Direct linkage feeding affords greater accuracy. Comes in 2" and 3" sizes. Write for detailed bulletin on this cost-cutter.

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CIRCLE INFORM-A-GRAM KEY NO. 1812

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DURANT "SURE-DRIVE" COIL CRADLE

Easy to load trouble free performance provides constant slack loop for feeding presses, forming rolls, shears, slitters, etc. Available in 11 models wide variety of capacity O.D. maximum ranges 36" to 48" and width maximum ranges 10" to 20".

WRITE FOR NEW FREE CATALOG

DURANT TOOL SUPPLY CO.
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Assures You Precision to the Finest Degree to Meet Your Requirements —Backed by the Name Supreme in the World of Measurement

BLOCK GAGES

(JOHANSSON) and accessories. Short deliveries. Inspection and reconditioning service available at our plant.

INTERNAL INDICATORS

(for inside measurements .155 to 24 inches). Scale range plus or minus .001 graduated to .0001 and minus .020 graduated to .0001.

MIKROKATOR

(Amplifier—for outside measurements) Graduations .0001 to .000001 or .01M to .0002M.

OTHER JOHANSSON PRODUCTS

Micrometers, Snap Gages, Extensometers, Dynamometers, Hardness Testers, Surface Finish Indicators, Interferometers, Plugs, Rings and Special Gages.

C E J MIKROKATOR 502-E

Mikrokator No. 502-E is a precision instrument for dimensional measurements.

It is provided with a mechanical, frictionless amplification device without sliding bearings or gears and there is no play, wear or binding.

The purpose of the instrument is to give accurate measurements both in mass production checking and in checking individual parts.

The instrument is made in three different designs and in both inch and millimeter.

Cat. No.	Range	Graduated	Shaft Diameter
502-E-2	.016	.0002	3/8"
502-E-4	.004	.00005	3/8"
502-E-5	.002	.00002	3/8"
502-E-6	.0012	.00001	3/8"

Write for Literature

C. E. JOHANSSON GAGE CO.
A DIVISION OF SWEDISH GAGE CO.
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CIRCLE INFORM-A-GRAM KEY NO. 1814

How to find a perfect mate!

SPITFIRE

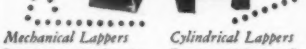
"Nth degree"
LAPPING MACHINES

Valve components, mechanical seals, many other parts require perfect mates . . . possible by producing surfaces of precision flatness and finish. This quality control is "built-in" around the world . . . with Spitfire Machines.

whatever your lapping requirements . . . SPITFIRE offers the proved answer:

Automatic Gyro-Matic "21"

Three basic elements: the human, mechanical and economical . . . are combined in the Gyro-Matic "21". Simple operation means any production worker can produce precision lapped parts. Micro-inch lapping to .0000116" flatness is standard. Rapid push-button control minimizes man-hours. Where critical parts are standard . . . so is the Spitfire Gyro-Matic "21".



Mechanical Lappers
Permits any size firm to incorporate super fine finishing on most production lines. The most economical method of attaining high level parts quality control.

Cylindrical Lappers
For closest tolerance finishes to 1 RMS or less on plug gages, shoulders, all types of cylindrical parts. Available in floor and bench type models.

Get full details . . . mail this coupon today!
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CIRCLE INFORM-A-GRAM KEY NO. 1821

Customers are very special

Customers are not ordinary people to us. They are special individuals whose respect and confidence has been earned and is cherished. We, at Lincoln Gage, are always conscious of the responsibility of customer confidence, so put forth that extra effort which makes the difference between good gages and excellent gages.

Standard and special cylindrical plug and ring gages are made with particular care. They are ground to the high limit of the tolerance then fully lapped to a fine micro finish. This adds extra wear life.

The majority of these fine gages, when worn undersize, can be restored by our special Lincaloy chrome plating process. The chrome will never peel or chip and any gage, so processed, will wear 200% to 400% longer. Worn thread gages can be also Lincaloyed. So do not discard them, send them to us for reworking.

LINCOLN GAGE COMPANY
23902 Harper Ave., St. Clair Shores, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1822

COLLINS

MICROFLAT®

BLACK GRANITE

- SURFACE PLATES
- ANGLE PLATES
- STRAIGHT EDGES
- LAYOUT PLATES
- PARALLELS
- T-SLOTTED PLATES

COLLINS MICROFLAT surface plates and precision accessories offer the user extreme accuracy —flatness in millionths!

All sizes— Write for bulletins.

☐ FREE Souvenir Paper Weight
☐ Microflat Technical Manual
☐ How To Calibrate Plates
☐ Black, Pink, Gray Granite Compared

CHECK DESIRED ITEMS AND MAIL WITH YOUR NAME & ADDRESS
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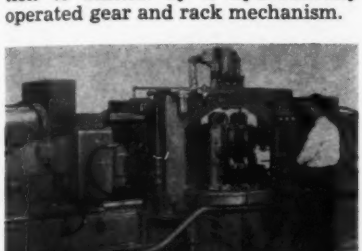
3249 W. El Segundo Blvd.
Phone: OSborne 5-4436
HAWTHORNE (Los Angeles County) CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 1823

AUTOMATIC INDEXING MACHINE PROCESSES 84 CONNECTING RODS/HR

A special, 3-way, 4-station, horizontal, automatic indexing machine for machining diesel connecting rods has been developed and built by Greenlee Bros. & Co.

Fixtures are manually loaded with two connecting rods and are mounted on the index table located at the first station. The two rods are then automatically clamped into position by a built-in, air-operated torque wrench. Pre-machined centers in each of the rods are for end-wise location in the fixture. The rods are then automatically indexed from station to station by a hydraulically operated gear and rack mechanism.



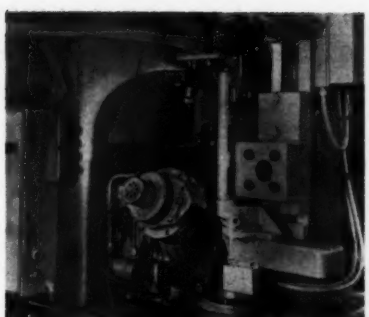
Wrist pin holes are drilled and the cap side of the crankshaft hole is bored at the second station. The rod end of the crankshaft hole is bored and the bolt bosses are milled square at the third. At station four, the wrist pin holes are semi-finish reamed while a sawing operation separates the cap from the rod. The rods and caps are, in turn, unloaded at station one.

Among other advantages of this machine are a built-in hydraulic system for all stations (conforming to J.I.C. standards), automatic lubrication, and chip disposal. All units are electrically interlocked.

AUTOMATING MACHINES ALREADY IN USE FOUND FEASIBLE

That it is entirely feasible to successfully automate machines already in use is being demonstrated in numerous plants today. Here is one of a large number of conventional single spindle hobbers automated by the Gear-O-Mation Division, Michigan Tool Company. Included is automatic loading, unloading, clamping and interlocking cycling, as well as size checking with a size control feedback system.

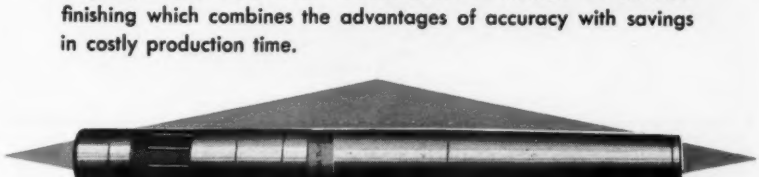
Blanks are fed along the curved gravity track from a demand storage system controlled by a micro-switch. To prevent any injury to the part they are released into the track singly by a switch controlled gate. From the track, the blanks are mechanically tipped 90° and stacked in a tubular magazine for positive alignment with the cycle-controlled spindles and arbor. Another micro-switch is used on the tubular magazine to cut power to the hobber when parts run out or in case of malfunction. After hobbing, the gears pass through an automatic checking fixture. Similar automatic loading designs are applicable to almost any part that rolls or slides.



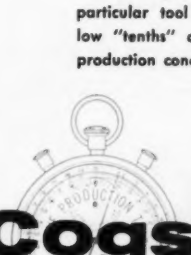
Bearing-izing

the last word in precision surface-finishing methods

The word "Bearingizing" describes the action of the production-proven Cogsdill Bearingizing tools. Designed and produced by Cogsdill, these tools offer manufacturers a method of surface-finishing which combines the advantages of accuracy with savings in costly production time.



The internal feed-in bearingizer, pictured above, has been developed for finishing and sizing of holes from 3/16" diameter and up. This particular tool can deliver quality finishing results with accuracy to low "tenths" and micro-inch readings well below 10 under volume production conditions in a matter of seconds.



Cogsdill Bearingizing Tools are engineered for each application to meet your requirements for bores, shafts, thrusts faces and some contours.

Cogsdill TOOL PRODUCTS, INC.
12980 W. Eight Mile Road, Oak Park 37, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 183

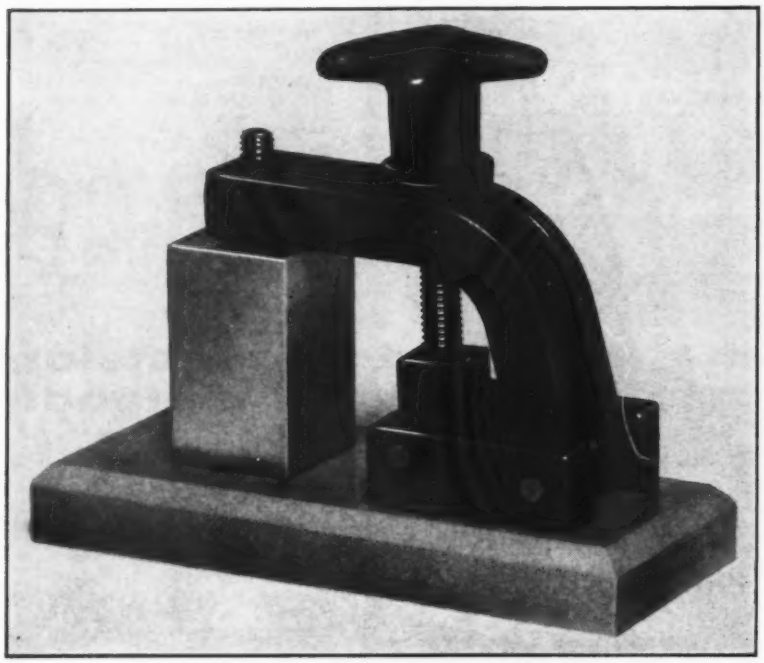
AUTOMATION METHODS UTILIZED TO COMBINE ASSEMBLY AND WELDING

A new high production 5-station rotary index welding machine has been designed to utilize automation methods for combining assembly and CO_2 shielded arc welding operations.

It press assembles and contour welds flat circular plates to the inside of cylindrical parts at a rate of 500 finished assemblies/hr. The machine, built by Expert Welding Machine Co., is adaptable to parts up to 5" dia that require press type assembly and circular weld joining.

The two spring collet type fixtures in each station are gear connected and rotated by means of a motor driven rubber wheel during the circular welding operations.

To begin the automatic assembly and welding operations, a cylindrical type part and a flat circular plate are partially loaded into each of the two fixtures at load station No. 1. The parts are then indexed through idle or optional load station No. 2 to assembly station No. 3.



In station No. 3, two air operated rams move downward and press assemble the circular plate into the cylindrical part in each of the two fixtures. During this operation, the two assemblies are also forced into the full length of the two spring collet fixtures and contact a lever type mechanism which pushes 5 ejector rams to an up position, one for each station.

The two gear connected fixtures, each containing an assembled part, are then automatically indexed to station No. 4 where one of the fixtures contacts a motor driven rubber wheel on its periphery. The rubber

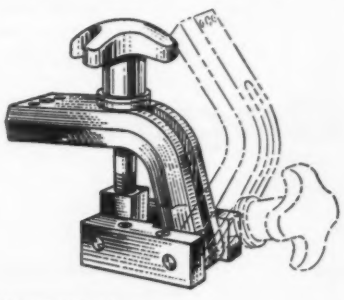
wheel rotates one fixture, which in turn rotates the second fixture through a series of gears. Two welding heads then automatically move into position by means of an air-powered lever type mechanism. Circular welds are then made on the rotating parts at the point where the outside diameter of the circular plate contacts the inside diameter of the cylindrical part.

The two fixtures containing the assembled and welded parts are next indexed to unload station No. 5.

An inverted "V" type mechanism, located inside the index table, contacts two pusher bars which partially eject the assemblies from the two fixtures. An air operated unloader arm automatically pivots downward and strips the partially ejected assemblies from the fixtures and deposits them in an unload conveyor chute.

LODDING RETRACTING CLAMPS

Lodding Retracting Clamps lend themselves to infinite variation. Jaws are added to suit work. Tapped and clear holes are there for you to use. Lodding provides four types of action—and your own imagination is the limit to the variety of jaws you can add. Four sizes each of four styles—hand knob, hand cam, nut and air operated.



LODDING, INC.
Worcester 1, Massachusetts

FACTORY WAREHOUSES

Precision Tool Sales, 417 E. Florence Ave., Los Angeles 3, Calif.
Bagby Engineering Co., 1047 Forest Ave., Evanston, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 184

Protect Your Future

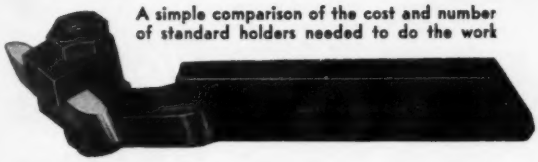
Buy U. S. Savings Bonds

TODAY!

Your Paymaster can Supply Complete Information Regarding the Payroll Savings Plan.

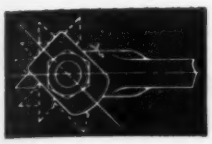
Walton-American

THE ONE "MULTI-POSITION" TOOL HOLDER REPLACING MANY!



A simple comparison of the cost and number of standard holders needed to do the work

of ONE Walton-American will quickly show you that this versatile Tool Holder is a money saver as well as a labor saver. The capacities of only four sizes range from 1/8" to 1/2".



The exclusive design of the Walton-American swivel head holds the tool in any position, giving perfect grip on round or square tool bits or boring bars. Illustration shows eight most commonly used positions.

If you are seeking ways to reduce your tool costs, it will pay you to investigate Walton-American. Write for Data Folder No. 38. We offer a liberal FREE TRIAL.

The WALTON Company
HARTFORD 10, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1851

THINK of it!

NOW you can have a boring head that will **BORE, FACE, TURN** and **GROOVE** at no higher cost than you would pay for an ordinary, single purpose boring head.

THINK

This over before buying that NEW head!!

A Boring Head That Won't Face is NOT Complete

Models for Any Size Machine

Write today for full details

CHANDLER TOOL COMPANY
MUNCIE, INDIANA

Model "D"

Chandler-Duplex

COMBINED BORING AND FACING TOOLHEADS

CIRCLE INFORM-A-GRAM KEY NO. 1852

NUMBERALL

CUTS THE COST OF STAMPING NUMBERS

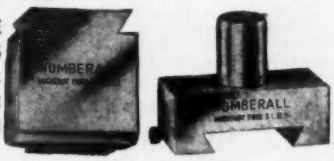
IMPROVED TYPE HOLDERS for stamping into Metal, etc.

STEEL TYPE

Hand or Press Style. Type can be easily, quickly loaded and unloaded. Simplest construction . . . just a sturdy pin holds the type securely. No screws nor springs. Super-quality steel type made in various sizes: 1/32" up to 1/2" figures and letters. Write for Bulletin TP-23H.

DOVETAIL ADAPTER
Model No. 116

SINGLE or MULTIPLE LINE TYPEHOLDERS with Dove Tail Shank allow **Quick** Changing of Type without taking holder out of the Press.



Write for Bulletin TP-116

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1853

"HILLCO" TANGENT CHASERS

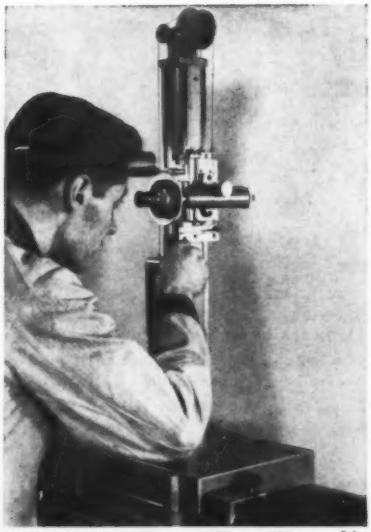
A NEW NAME FOR AN OLD ESTABLISHED PRODUCT

In the interests of standardization the line of ACME Tangent Chasers have been modified slightly in dimensions so that they now are adaptable to other makes of die heads in addition to ACME die heads. This complete line of tangent chasers is now known as "HILLCO". "HILLCO" tangent chasers can be reground for 80% of their original length. The same precision and long wear are guaranteed that have made our chasers a standard through 75 years of cutting tool manufacture.

TOOLS FOR INDUSTRY

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1854



M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

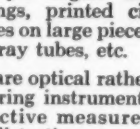
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53

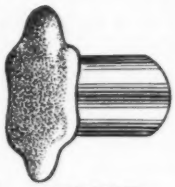
The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

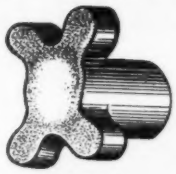
CIRCLE INFORM-A-GRAM KEY NO. 1861

REID TOOL ROOM *Accessories*

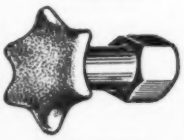
CAST IRON HAND KNOBS



SCALLOPED



PRONG



LONG SHANK
With Wrench Hexagon

Made in three types and a wide variety of sizes. Designed to improve appearance of product. Well proportioned with eye appeal. Made of fine grain cast iron. Smooth finish—no sharp edges. Can be supplied drilled and tapped or drilled and reamed when desired. Low prices.

Quality at Moderate Prices!

Also

Get our low prices for plastic and steel ball handles, machine handles, compression springs, etc.

FREE 64 Page Catalog

REID TOOL SUPPLY CO. Muskegon Heights, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1862

MICRO-MINIATURES...

Small END MILLS AND ROUTER BITS

Ground from SOLID. Made to do a NEW job of milling and routing at high speed and fast feed on production runs as well as in the tool room.

THE SECRET

of their durability and long life lies in our method of grinding which produces a smooth, unbroken cutting edge. No saw-tooth edge to load-up and break-down.

See the display of Micro-Miniatures at your jobbers or write us for details.

DISTRIBUTORS *in principal cities*

When you think of small END MILLS — think of MICRO MINIATURES

Write for Catalog

WOODSON TOOL CO. 4811 Lennox Blvd. Inglewood, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 1863

HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses —

—core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1864

Dan R. Scott has been named sales manager for the Allied Products Division of Motch & Merryweather Machinery Co.

◆

E. J. Reitler has taken over as sales manager of Firth-Loach Metals, Inc.

◆

Gene H. Whitfield has become a Carboloy carbide cutting tool sales representative for the Metallurgical Products Department, General Electric Co. He is covering the Cleveland East Central district which includes Evendale, Ohio, and parts of several states south of Cincinnati, Ohio.

◆

Peter Iaffaldano is the new field engineer assigned to the Cleveland district office of Norton Co.

◆

The manager of the new West Coast branch of Huck Mfg. Co. is **Richard A. Villacres.** The warehousing and service facility is located in Englewood, Calif.

◆

Centre W. Holmberg, Jr. has been elected vice president in charge of sales for August W. Holmberg & Co., Inc.

◆

Detroit Tap & Tool Co. has disclosed the appointment of **Fritz Walters** as sales and service manager.

◆

David W. Bonnar has been assigned to new duties in the sales department of Clearing Machine Corp., division of U. S. Industries, Inc., serving as senior sales engineer on major accounts.

◆

The appointment of **Charles J. Wacker** as sales manager of the Stampings Division has been announced by Sterling Tool & Mfg. Co.

◆

John H. Biggs has become district sales manager for the Machine Tool Division of Brown & Sharpe Mfg. Co. The new district sales manager for the company's Industrial Products Division is **Robert E. Berger.**

◆

Donald E. Lake has been promoted to sales manager of the Ohio Division of Associated Spring Corp.

◆

Crucible Steel Co. of America has announced the appointment of **William B. Downes** as manager-Stainless Steel Sales Division, with headquarters in Pittsburgh. He will be responsible for sales of the company's stainless steel products.

◆

O. S. Haskell has joined the sales organization of Lindberg Engineering Co. and Lindberg Industrial Corp. He will serve as field representative for the East Coast sales offices, operating out of the Greenwich, Conn., office.

William Lehr is serving as manager of the new district sales office in Atlanta, Ga., recently opened by the Tubular Products Division of The Babcock & Wilcox Co. The office serves Georgia, South and North Carolinas, Alabama, Florida and the southeastern section of Tennessee.

◆

J. R. Boehm has been appointed sales representative in western New England for The L. S. Starrett Co. He succeeds **C. A. Bassett,** who recently was named general sales manager. **W. E. Clark, Jr.** is covering the Pittsburgh area, replacing **J. E. Hindes,** who has retired.

The new sales manager of the Industrial Division of Warner Electric Brake & Clutch Co. is **Roger H. Brown.**

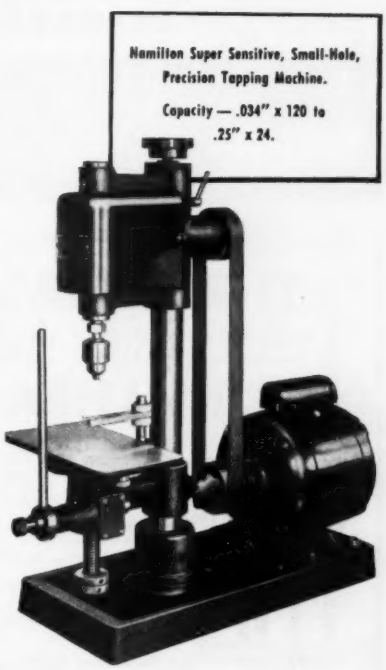
◆

Putnam Tool Co. has named **William Easterly** as sales representative for the northern portion of the West Coast area. He will cover northern California, Oregon and Washington, handling Putnam end mills.

◆

Herbert B. Clark has taken over as Eastern district manager for Vascoloy-Ramet Corp., with headquarters in Philadelphia.

Now *Precision* TAPPING OF THIN AND BRITTLE MATERIALS



Recent design change provides a simple homing device as a standard component of the

HAMILTON
SUPER SENSITIVE, SMALL-HOLE
PRECISION
TAPPING MACHINE

and makes routine of such problem work as the tapping of precision holes in thin metal sheets or in brittle plastics. Even improves performance in the tapping of blind holes!

YOU

will want full information about this important development!

WE WILL FURNISH IT

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BULLETIN No. 2463

ADDRESS

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

2463

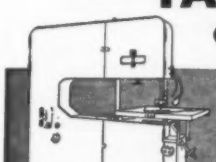
CIRCLE INFORM-A-GRAM KEY NO. 187

FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

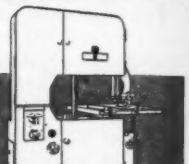
FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN ☎ GL-6-1729



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.

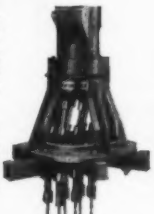


CIRCLE INFORM-A-GRAM KEY NO. 1881

THRIFTMASTER
your source for dependable
DRILLHEADS

Universal Joint Type Drillhead . . . Full Ball or Bronze Bearing Construction, Standard or Heavy Duty. From ½" minimum centers up. Capacities to ½" in Steel.

Gear Driven Eccentric Type Adjustable Drillhead . . . Enclosed, Full Ball Bearing Construction. Double Eccentric Type Adjustable Drillhead illustrated.



- We stock or can build the right drillhead for your jobs.
- Write for your free copy of the THRIFTMASTER CATALOG or phone for a rush, on-the-spot, quote.

Makers of
DORMAN AUTOMATIC
REVERSE TAPPERS

Special Fixed Center Drillhead . . . Made to your requirements. Full Ball Bearing Construction.

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Products Corporation
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

1012 N. Plum Street
Lancaster, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 1882

FREE... 64 PAGE CATALOG

WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
write for your copy - TODAY!

JERGENS TOOL SPECIALTY CO.
Dept. TP-5, 712 E. 163rd St., Cleveland 10, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1883

GROWING PAINS

General Electric Company has agreed to purchase the manufacturing plant of **Electric Auto-Lite Company** in Evendale, Ohio. The property consists of two manufacturing buildings containing 3,300,000 sq ft of floor space. The purchase is part of GE's company-wide plant expansion and improvement program which this year will exceed $170 million. It will provide additional space for making Aircraft Gas Turbine Division products.

◆

Borg-Warner Corporation is planning to invest approximately $26,000,000 in new plants and modern equipment this year. Part of this sum will be used to complete a new $10,000,000 chemical plant of the corporation's Marbon Chemical Division in Washington, W. Va., which manufactures a tough plastic, Cycolac. Another portion of the money will provide for additions and improvements to Borg-Warner facilities in the Chicago area. The balance of the funds will go to the Norge, York, Warner Gear, and Byron Jackson Divisions and for a proposed new factory for the Warner Automotive Parts Division at Auburn, Ind.

◆

Electro Refractories & Abrasives Corporation has allocated $157,000 for expansion and modernization of its Buffalo and Canadian plants.

◆

The Clark Controller Company has completed arrangements to purchase a 170,000-sq-ft building from **Western Electric Company** and **The Ohio Bell Telephone Company.** Clark Controller, which manufactures electrical control components and systems, will use the building for expansion of its manufacturing and warehousing capacity.

◆

Ground has been broken in Athens, Ga., for a new multimillion-dollar distribution plant for **Westinghouse Electric Corporation.** The plant will double the company's present capacity for producing distribution transformers. Westinghouse is also planning to build a plant in Trafford, Pa., to manufacture switchgear apparatus. This facility will be occupied by the power circuit breaker department of the East Pittsburgh Division.

Finn Aeronautical Division is doubling its facilities by acquiring a 10,000-sq-ft plant adjacent to the present plant. The company specializes in the fabrication of missile and jet engine prototypes.

◆

The expansion of the Nuclear Division of **Stanat Manufacturing Company, Inc.** is scheduled to be completed this spring. The division manufactures nuclear metal processing machinery which includes rolling mills, rotary gang slitters, and roller levelers designed to protect personnel from radiation hazards.

Link-Belt Company has announced the second major expansion in two succeeding years at the Cedar Rapids, Ia., plant of its subsidiary, **Link-Belt Speeder Corporation.** The new structure, providing more facilities for assembly, machine shop, and other operations, will increase by 40% the production of power cranes and shovels.

◆

An auxiliary plant has been opened in Cleveland by **Lester-Phoenix, Inc.** The facility will be used for machining operations on Lester injection molding machines and die casting machines.

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table

A PORTABLE HEIGHT-ADJUSTABLE TABLE
● TRUCK
● WORK BENCH

for DIE TRANSFER
● MACHINE FEEDING
● ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

LIFTING
● LOWERING
● TRANSPORT of SHEETS PLATES BARS TUBES PIPES TOOLS DIES FIXTURES
● ALL COMPACT HEAVY LOADS

UNOBSTRUCTED PERIMETER
●
WORK FROM ANY SIDE

MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

43 table surfaces point support

Recent changes and additions to the line provide greater capacities, new flexibility, *many bonus features*.

Write for NEW, FREE Bulletin P-5604

Address THE HAMILTON TOOL COMPANY, 832 South Ninth Street, Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

5604

CIRCLE INFORM-A-GRAM KEY NO. 189

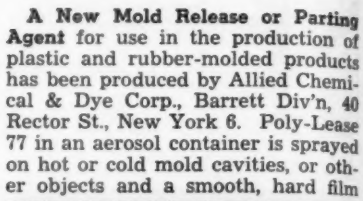
- *New Equipment*
- *New Materials*
- *New Literature*

WHAT'S NEW IN

A New Flexible Epoxy Potting and Casting System with moderate cure at 75°C, permits encapsulation of temperature-sensitive electronic components. Hysol 6900 Series is also used for potting of coils, amplifiers, connector plugs, transformers and submersible assemblies. For details on the series sold in two-component units in three sizes, see a technical bulletin from Houghton Laboratories, Inc., Olean, N. Y. or — **No. E1.**

Reinforced Glass Injection Molding Compounds, Styrene G and Nylon G, assuring quick, easy molding jobs, are rugged, rigid, and heat resistant, and feature unsurpassed ability to control mold shrinkage and warpage. A folder, "Reinforced Insurance for All Injection Molding," giving the properties and applications of the compounds, is supplied by Fiberfil, Inc., Fox Farm Rd., Warsaw, Ind., or—**Circle Inform-A-Gram No. E2.**

A New Mold Release or Parting Agent for use in the production of plastic and rubber-molded products has been produced by Allied Chemical & Dye Corp., Barrett Div'n, 40 Rector St., New York 6. Poly-Lease 77 in an aerosol container is sprayed on hot or cold mold cavities, or other objects and a smooth, hard film



forms quickly which provides efficient release with a minimum number of spray applications. This action results in faster cycle time, reduction of rejects, and lowering of production costs. The release agent has been particularly successful in the casting of epoxy plastic prototypes and tools because it permits repeated reproduction of these items in the same mold.
Circle Inform-A-Gram No. E3.

Fast Press Cycle, High Output per Cavity, and Easy Setup are features of a new fully-automatic compression molding press. Model 741 has pre-set feed boards which are matched to a particular mold. The press is equipped with either positive bottom or top ejection. Direct feeding of the loading board from the hopper and controlled vibration permit the use of a wide range of molding materials. The press is available in 50, 75, 125, and 200-ton capacities. F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, or — **Circle Inform-A-Gram No. E4.**

A Hand Lay-Up System of Epoxy Resin Laminations is described from model to cure in a technical bulletin. Covered is the glass-laminated epoxy-resin impressions for use in metalworking, and model and pattern reproducing. The impression can be taken from molds, patterns, or mock-ups of plaster, wood, or metal that are used as dies, jigs, checking fixtures, Keller patterns, or molds. Included are procedures such as preparation of models of plaster, wood and metal, and other nonporous materials. Also presented are suggestions for handling, mixing, and weighing, and care of tools and brushes. Direct requests for Technical Bulletin 22 to Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J., or — **Circle No. E5.**

LEMPCO STYLE "M" and "L" DIE SETS

NEW

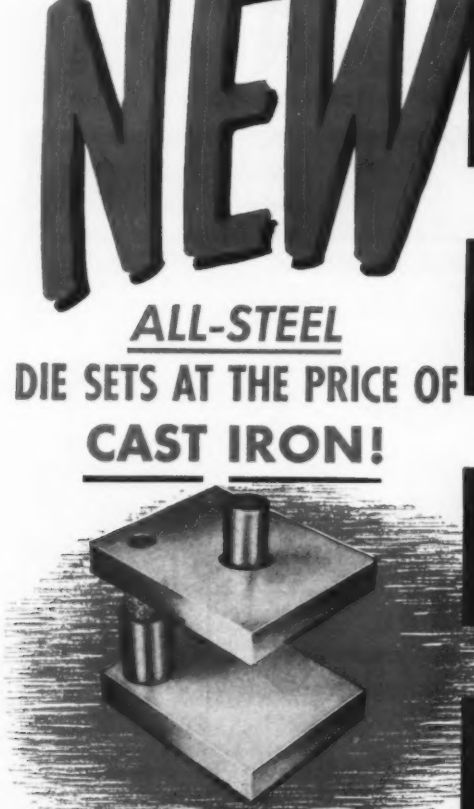
ALL-STEEL
DIE SETS AT THE PRICE OF
CAST IRON!

BALL-BEARING ANTI-FRICTION PIN BUSHINGS

EASIEST AND FASTEST TO ASSEMBLE OR DISASSEMBLE

PRECISE ALIGNMENT FOR MILLIONS OF STROKES

ZERO MAINTENANCE; ONLY CUP GREASE AT GRINDING TIME



NOW, Lempco's line of Precision Ball-Bearing Die Sets, includes new low-priced *all-steel* sets, Style "M" and "L", at the price level of *friction-type cast iron* die sets. Better write TODAY for New Low Prices!

LEMPCO INDUSTRIAL, INC.
DUNHAM RD., BEDFORD, OHIO

WHERE QUALITY CONTROLS!

CIRCLE INFORM-A-GRAM KEY NO. 190

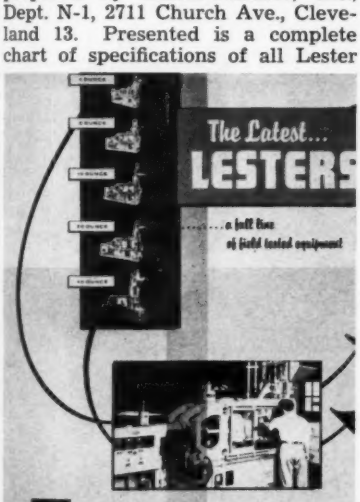
IN PLASTICS?

- *Plastics Fabrication*
- *Plastic Tooling*
- *Plastics Molding*

Produce Small Molded Plastic Products quickly and easily with major cost savings with a new line of improved Mini-Jector plastic injection molding machines. These machines, incorporating small, low-cost, parting-line sprued molds of 1/3 to 1 oz. capacity, will mold any thermoplastic, including nylon. They are also designed for solving difficult insert molding of wires, cables, cords, rods, etc. into plastic plugs, unions, and handles. Minijectors are available in various models to suit individual requirements including air or hydraulic power with simple lever or pushbutton controls. Newbury Industries, Newbury, O., or—**Circle Inform-A-Gram No. E6.**

Reduce Tool and Pattern Making Time and cut the cost of many applications with Epoxical plastic tooling. A bulletin describes several laminating and casting techniques. Shown is the procedure for a plastic checking fixture. In addition, the bulletin presents photos of laminating a plastic foundry pattern and a Keller pattern or spotting fixture. Also included is a section on tooling tips and good shop practice. The last section is devoted to casting Epoxical foundry patterns. Copies of IGL Bulletin 402 are made available by U. S. Gypsum, 300 W. Adams St., Chicago 6, or — **Circle No. E7.**

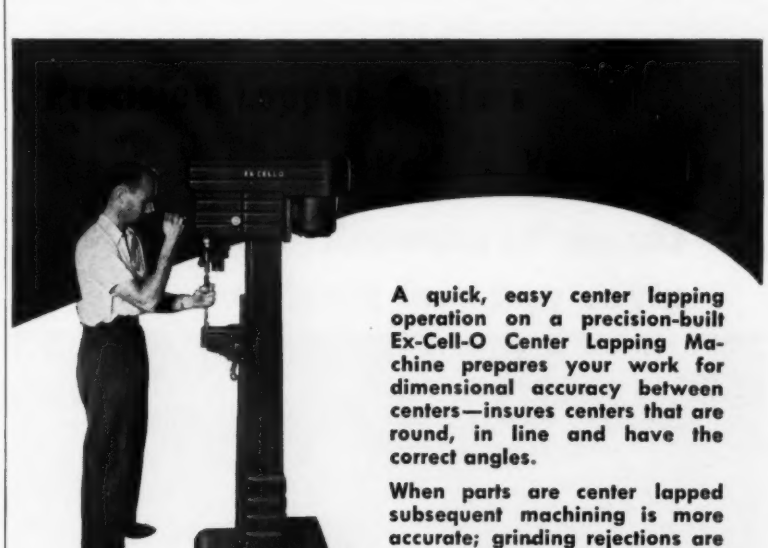
The Features of Injection Molding Machines are detailed in Bulletin 202 prepared by Lester-Phoenix, Inc., Dept. N-1, 2711 Church Ave., Cleveland 13. Presented is a complete chart of specifications of all Lester



models and a list of users. Also included are typical installations and cutaway views of basic components. For complete information, obtain a copy of the bulletin from the company, or — **Circle No. E8.**

Industrial Laminates are featured in Folder 106F from Farley & Loetscher Mfg. Co., Dubuque, Ia. Given are the base materials, sizes and tolerances, applications, and fabricating techniques. An industrial laminates specifications table gives paper base grades and fabric base grades, complete with descriptions and applications, grade numbers and colors, and mechanical and electrical properties.
Circle Inform-A-Gram No. E9.

"Use of Adhesives with Reinforced Plastics" contains data on the effect of temperature on tensile shear strengths, physical properties of foamed-in-place plastic "sandwiches," and bond properties of printed circuit laminates made with various adhesives. For copies of the technical booklet, Leaflet 142, with tables, charts, and diagrams, contact Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J., or — **Circle Inform-A-Gram No. E10.**



A sturdy base and column support the motor and precision spindle on Ex-Cell-O Center Lapping Machines. Note adjustable work rest. Scraped ways assure perfect alignment of work rest center with spindle.

A quick, easy center lapping operation on a precision-built Ex-Cell-O Center Lapping Machine prepares your work for dimensional accuracy between centers—insures centers that are round, in line and have the correct angles.

When parts are center lapped subsequent machining is more accurate; grinding rejections are minimized; and selective fitting time is abolished. That's why an Ex-Cell-O Center Lapping Machine will pay for itself quickly in your shop.

Contact your Ex-Cell-O representative or write for center lapping bulletin.

A sharp, accurate 60° point is maintained on the lapping stone with a spindle-bracket-mounted diamond dresser. (Adjustable dressers for other angles are available.) Dresser swings out of the way when not in use.

XLO
56-4

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 191

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Self-Opening Die Heads are featured in Bulletin 117 issued by Chaso Tool Co., Inc., Box 268, N. Branch, Mich. Style RD die head is designed for use on hand screw machines in a stationary position. The bulletin also shows parts for Types RD and D die heads. In addition, information for operating the die heads is presented. Contact the company for copies of the bulletin, or —
Circle Inform-A-Gram No. B1.

The New Walker-Turner Grinder Line is described in a bulletin now available from Rockwell Mfg. Co., Walker-Turner Div'n, 400 N. Lexington Ave., Pittsburgh. These light-heavyweight machine tools include a surface grinder, bench and floor model tool grinders, workholding accessories and a metal dust collector. For copies of the bulletin, Form WT-43, contact the company, or —
Circle Inform-A-Gram No. B2.

Buck AJUST-TRU CHUCKS

Chuck "teamwork" that gives you real precision

The Ellis Dividing Head is made for precision operations. The Buck 3-jaw chuck adjusts to dead true precision in 1 minute. Put the two together and you have a real performing team.

Buck Ajust-Tru chucks — 2-jaw, 3-jaw, 6-jaw — provide dead true precision and *guarantee precision within .0005" on production runs!* They help you make the most of every tool's or machine's precision capabilities.

It pays to chuck with Buck!

NEW '57 CATALOG
ready — send for your copy

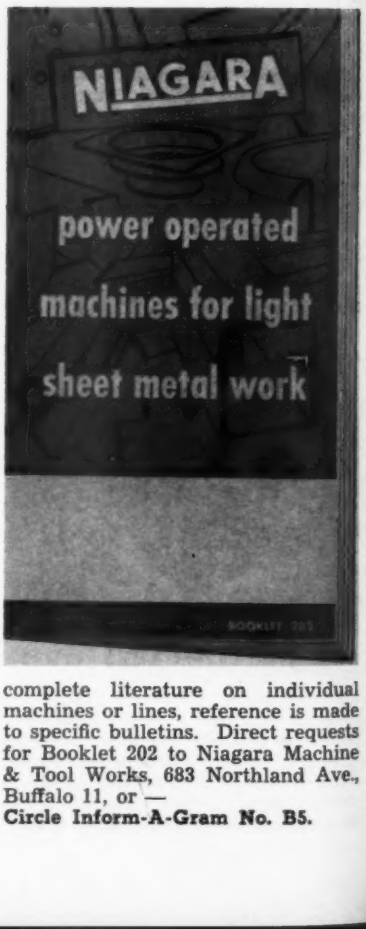
BUCK TOOL COMPANY
518 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 192

Model VS Engine and Toolroom Lathe is featured in Bulletin A56VS from The Carroll-Jamieson Machine Tool Co., Batavia, O. This 16" variable speed lathe features standard taper key drive spindle nose and a wide range of threads and feeds. These and other features are detailed in the illustrated bulletin and the specifications listed. Also covered are the attachments. For your copy of the bulletin, contact the company, or—**Circle Inform-A-Gram No. B3.**

A Complete Line of Horizontal and Vertical Milling Machines is highlighted in a folder from Crowningshield, Inc., 71 Country Club Rd., Greenfield, Mass. Covered are nine models included in the line. Each model is shown and described, and the features and specifications listed. Also noted are their applications. Get your copy of the folder from the company, or — **Circle B4.**

This Vest-Pocket Catalog summarizes important data on Niagara power operated machines for light sheet metal work. It is the second in a series on Niagara machines and tools, providing quick reference to all principal models in a line. For



complete literature on individual machines or lines, reference is made to specific bulletins. Direct requests for Booklet 202 to Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, or —
Circle Inform-A-Gram No. B5.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Sound, Vibration and Strain Measurements are performed by Brush-Bruel & Kjaer instruments. They are described in a condensed catalog. Included are 28 recently introduced instruments and accessories. Each instrument is described and illustrated. Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, will release copies of the condensed catalog, or—**Circle Inform-A-Gram No. B6.**

"What You Should Know About the Carboloy Customer Education Program" is the 16-page booklet which has been issued by Metallurgical Products Dept., General Electric Co., Detroit 32. The booklet describes why the program was created, types of schedules followed, facilities and methods of instruction. Instruction covers not only cemented carbides, but also new developments in cutting tool materials.
Circle Inform-A-Gram No. B7.

A New Line of Ovens is detailed in literature provided by L & L Mfg. Co., 136 - 8th St., Upland, Pa. The Turbo-Convection ovens are designed for accurate heating such as tempering, normalizing and drawing of both ferrous and non-ferrous metals. They are also used for drying of ceramics, mold drying and heat processing of plastics. Six standard models are available.
Circle Inform-A-Gram No. B8.

Simplified Experimental Stress Analysis is possible with the ST-103A Stresscoat Outfit, a complete kit for determining and evaluating stresses. Stresscoat is a brittle lacquer coating used to reduce the time and cost of experimental stress analysis. It enables the design engineer to obtain a quick analysis of static load stresses, impact stresses, yield, residual stresses and dynamic stresses. Details are in a bulletin supplied by Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, or —
Circle Inform-A-Gram No. B9.

Miniaturized Stainless Steel Screws, Nuts and Washers are listed in a supplement to the regular catalog issued by Albany Products Co., Inc., Connecticut Ave., S. Norwalk, Conn. They are available in sizes No. 0, No. 00 and No. 000. Copies of the supplement are made available by the company, or —
Circle Inform-A-Gram No. B10.

More Than 4,000 Different Fasteners available from stock are included in a brochure from The Chicago Screw Co., Bellwood, Ind. Standard fastener categories are described and illustrated along with the company's engineering, quality control and delivery services. Also presented is information on the Carbon Restoration process. For your copy of the brochure, write to the company, or—
Circle Inform-A-Gram No. B11.

A Petro-Engineering Service giving assistance on problems involving fuels, lubricants and other products of petroleum is being offered by Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30. This service, which is provided cost-free by Gulf, is backed by 1300 scientists, engineers, metallurgists and chemists. Complete details are found in a 24-page booklet published by the company, or —
Circle Inform-A-Gram No. B12.

NEW

Buck

BORING BAR

Gives you new precision, speed, and economy

(A)

Shows why the Buck is more rigid and stronger. *Full* shank of cutter is supported by bar, locked in by three screws.

(B)

Shows adjusting screw behind cutter at end of bar. Provides adjustment to tolerances as precise as machine permits — even on 1" bars.

• • • •

There are 30 sizes of Buck Boring Bars ranging in boring capacities from a minimum of $^{25}/_{32}$" to a maximum of 6¼".

The rigidity for heavier, faster cuts — plus precision adjustment to tenths — is now available with the Buck.

You can spot the design advantages. Cutter is "out front." Provides ample chip clearance. Permits use of bigger shank for greater strength and rigidity.

The Buck uses standard cutters. Cutting edges are always on center — means less, and sometimes no, tip grinding. This, plus super rigidity, means longer cutter wear and permits using the better grade of carbide tools.

This just begins to list the many features. Write for complete details.

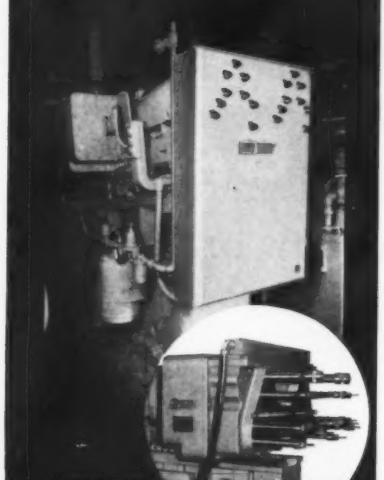
BUCK TOOL COMPANY
518 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 193

Reduce Vibration and Noise with universal Lev-Elasto dampers. They are easy to install and highly effective for most types of machinery. These dampers eliminate bolting to floors and permit quick installation or rearrangement of production lines. They feature a built-in leveling device providing up to ¾" adjustment. Bulletin K2D containing complete information is provided by The Korfund Co., Inc., 48-15 — 32nd Pl., Long Island City 1, N. Y., or — **Circle Inform-A-Gram No. B13.**

Eliminate Drill Jigs with a numerically controlled positioning table that can be used for one piece layouts. It reduces work-inventory and long production lead time. A folder describes a drill press with numerical positioning table and notes the advantages of the equipment. In addition, the method of operation and tape preparation are detailed. For more information, request folder from Jones & Lamson Machine Co., Springfield, Vt., or — **Circle Inform-A-Gram No. B14.**

U. S. NAVY PHOTO



US Individual Lead Screw Tapping Head automatically signals on a light panel exact location of any spindle not tapping to full depth, and stops the entire line. In addition, patented US Safety Tap Spindles prevent all tap breakage due to dull taps or improperly drilled holes. Installed on transfer machines, this exclusive US development provides dual automatic protection during tapping without need for an extra probing station.

Trouble Spotter...

This majestic cruiser is a U. S. Navy airship. Its mission is locating trouble—*ahead of time.* How effective its deadly purpose in convoy is attested by the fact that "no vessel escorted by a blimp in World War II was sunk by an enemy submarine." Its invaluable contribution to our Aircraft Early Warning system is also firmly established. It is a Navy "tool" that virtually eliminates surprise.

The U. S. Drill Head Co.'s new electronic device seeks trouble too—in automated production lines. It locates faulty machining during a "transfer setup" and stops the machine *before* succeeding operations are begun. It minimizes the chance of costly smash-ups and resulting expensive down-time . . . reduces re-operating and scrap-loss costs.

This development is another precision cost-reducing "tool" from the largest exclusive drill head builder in the world.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 194

Milling, Broaching and Grinding Machines are included in the new General Catalog M-1961 published by The Cincinnati Milling Machine Co., Cincinnati 9, O. Also covered are cutter and tool grinding machines, grinding wheels, selective

hardening machines and cutting fluid. In addition, sections are devoted to metal forming machines and special machine tools. For your copy of the catalog, contact the company, or—**Circle Inform-A-Gram No. B15.**

For Automotive and Industrial Use are the air compressors covered in the 20-page illustrated catalog published by Kellogg Div'n, American Brake Shoe Co., Rochester 9. Given are complete specifications on single and two-stage models, portable models, tanks, pumps and accessories. Also included are charts and data on compressed air. The company will provide copies of the air compressor catalog, or — **Circle Inform-A-Gram No. B16.**

Produce Parts by Cold Flowing various metals into tubular forms of all sizes and shapes. A brochure describes typical parts that can be produced by the Flotrusion process which eliminates machining, burring, polishing and honing. In addition, the brochure points out the advantages of the process. The brochure, "Why Machine It? Use Flotrusion," is issued by Claude C. Slate Co., 1733 Flower St., Glendale 1, Calif., or — **Circle Inform-A-Gram No. B17.**

High Speed Steel and Carbide Tools are produced by George L. Detterbeck Co., 1871 Clybourn Ave., Chicago 14. Among the tools manufactured are cutting cams, carbide form tools, tool bits, box tools, and revolving stops. These tools assure smooth cutting, fine finish and long life. Additional details are given in a circular from the company, or — **Circle Inform-A-Gram No. B18.**

Gage Company PRECISION PLASTIC

COMPARATOR SCALES

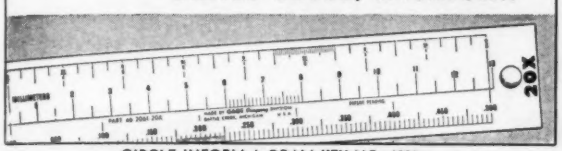
Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

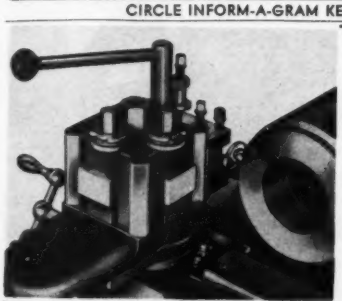
WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY

BATTLE CREEK, MICHIGAN



CIRCLE INFORM-A-GRAM KEY NO. 1951



- Clamp with guaranteed accuracy of .0001".
- Adjust Cutters to proper height easily and quickly.
- Make unlimited tool changes and operations with different tools.
- Save considerable set-up time — up to 90% — in individual as well as production work.

MODERNIZE YOUR LATHES!

PRODUCE MORE WITH GREATER PRECISION!

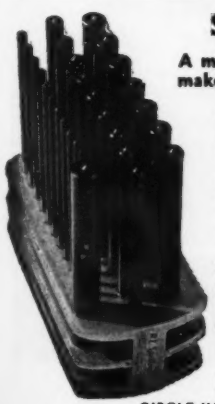
MASTER MULTI TOOLHOLDER "BONI"

Five sizes available for center heights from 4" to 18".

Sole U.S.A. Representative

NEISE MODERN TOOLS **KARL A. NEISE** 404 4th Ave., Dept. T.P. New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1952



SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—Sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1953

New **CATALOG**

WM. SOPKO & SONS CO.

GRINDING WHEEL ADAPTERS

AND TOOLROOM ACCESSORIES

finest quality **ADAPTERS**

- Precision-made, Hardened and Ground with Heat Treated Nuts
- Complete Line—4 New Models Available
- For Use on All Popular Surface Tool and Cutter Grinders
- Large Stocks—Immediate Delivery

USE SOPKO ADAPTERS—SAVE TIME, TROUBLE AND MONEY

WM. SOPKO & SONS CO.

140 E. 267th ST. • EUCLID 32, OHIO

Please send your New Free Illustrated CATALOG

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 1954

NOW...
a tamper-free

TRUE PRESS COUNT

Model L Load Counter

control devices

- Pinpoints bottlenecks
- Detects Shrinkage
- Controls Inventories

Employs strain gage mounted on press side. Counts only work strokes, rejects counts from idle strokes. Register unit may be mounted adjacent to, or remote from press.

Technical brochure and application data upon request.

INCORPORATED

8299 E. Nine Mile Van Dyke, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1961

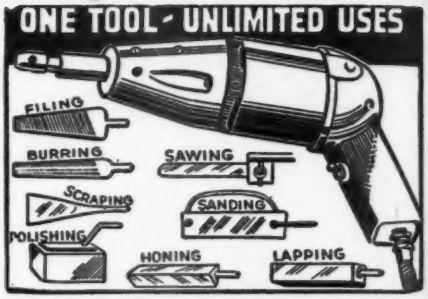
B-R-E-A-K...
Hand Finishing Bottlenecks

WITH

PORTABLE • ELECTRIC
RECIPROCATING TOOLS

These handy tools will cut out many tedious hand filing and finishing operations — Increase Production — Produce Uniform Work.

Light in weight — Delivers 1/8" or 3/16" fixed stroke at 1000 strokes per minute — Operates on 110 volts AC or DC.



ACME TOOL COMPANY

75 WEST BROADWAY NEW YORK 7, N. Y.

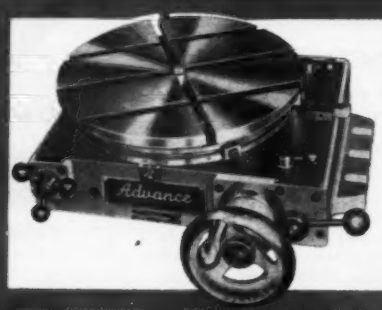
CIRCLE INFORM-A-GRAM KEY NO. 1962

Developed by TOOL MAKERS for TOOL MAKERS

ADVANCE CROSS-SLIDE ROTARY TABLE

Permits fast, precise positioning of workpiece from ONE SET-UP. No unclamping and reclamping on your standard vertical mill equipped with ADVANCE Cross-Slide Rotary Table.

30 Seconds Accuracy



ADVANCE 15" ROTARY TABLE

This rugged, precise tool is designed for all types of work requiring rotational accuracy. Its maximum speed and precision, and minimum maintenance fills the need for a precision unit at a moderate price.

Full details on request.

MORRISON ENGINEERING COMPANY

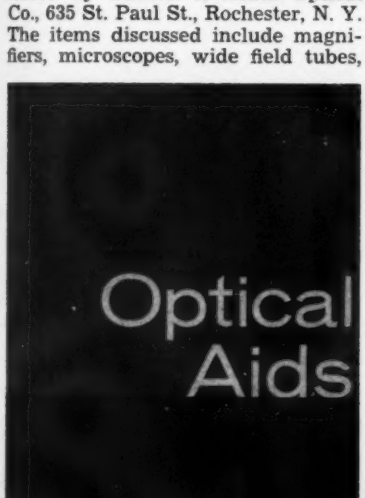
CIRCLE INFORM-A-GRAM KEY NO. 1963

Grind Either the Right or Left Side of a Cutter to a 90° Radius with the Nassau convex radius grinder. It can also grind a full 180° convex radius. Form dressing of the wheel is eliminated. A bulletin presents set-up and operating procedure, and construction details. In addition, it gives a plan view. Copies of the bulletin are made available by Nassau Tool Work, Elmont, L. I., N. Y., or—**Circle Inform-A-Gram No. B19.**

Steel Press Brakes are highlighted in Bulletin 57PR announced by Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36. Series D press brakes are available in 40 standard sizes with capacities from 90 to 450 tons. The bulletin describing all the principal features and giving specifications and capacities of the standard sizes, is made available by the company, or —
Circle Inform-A-Gram No. B20.

The Conomatic-Pilot Automatic Multicycling Copying Lathe is described in a bulletin issued by Cone Automatic Machine Co., Inc., Pilot Div'n, 30 Rockefeller Plaza, New York 30. Included are design details and specifications. Also presented are diagrams of a series of typical parts profile-turned on the lathe, giving dimensions and machining times, and showing the tool arrangement used for each.
Circle Inform-A-Gram No. B21.

Ways to Use Low-Cost Optical Instruments to Cut Production Costs are outlined in a new booklet published by Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y. The items discussed include magnifiers, microscopes, wide field tubes,



microscopes and comparators. For complete details, get Booklet D-1059, "Industrial Optical Aids," from the company, or —
Circle Inform-A-Gram No. B22.

Engineering Data and Test Procedures are presented in a 12-page catalog issued by MacLean-Fogg Lock Nut Co., 5535 N. Wolcott Ave., Chicago 40. It contains American Standard dimension tables on lock nuts and semi-finished nuts as well as data on wrench torques and test procedures for prevailing torque type lock nuts. In addition, detailed information is supplied on the Uni-Torque lock nut and the new two-way lock nut.
Circle Inform-A-Gram No. B23.

The O.G.P. Multi-Use Stage Booklet describes the versatile staging fixture recently developed by Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y. The booklet shows pictorially how the various holders can be used to stage a wide variety of parts on all makes of optical comparators. It includes drawings and dimensions of the standard part holders and end stops available. Dimensional drawings of the stage itself are also included.
Circle Inform-A-Gram No. B24.

How to lower your production cost
with the right Spindle for your job
and the right Spindle Service

SPECIFY POPE PRECISION SPINDLES

POPE designs and builds precision anti-friction bearing spindles — belt driven, motorized or high frequency — for your standard or special machines for milling, boring, grinding, drilling, cutting and many other operations. *More than 20,000 different Spindles to choose from.*

POPE builds spindles to *your design.*

POPE builds *special* spindles for use in your own shop for grinders, boring machines, etc.

POPE provides standard *replacement* spindles for your present shop equipment.

POPE provides *repair* and *rebuilding* service for any make of spindle — belt driven, motorized or high cycle.

POPE provides *precision parts* for your spindles, such as shafts, flingers, locknuts, sleeves, spacers, etc.

POPE provides *interchangeable extension arbors* for your internal grinding spindles — *wheel holders* for any spindle — any size wheel. Just send us your specifications.

Write for price and delivery

SPECIFY POPE PRECISION SPINDLES

No. 119

POPE®
ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE
POPE MACHINERY CORPORATION · 261 RIVER STREET · HAVERHILL, MASS.
Established 1920

CIRCLE INFORM-A-GRAM KEY NO. 197

A Combination Feeder and Plug-In Busway is the subject of Bulletin GEC-1446 from General Electric Co., 41 Woodford Ave., Plainville, Conn. Type LVDP combines high-capacity, low-voltage-drop characteristics with plug-in flexibility. The bulletin describes and illustrates the busway and discusses its applications. In addition, the specifications, ratings and dimensions are listed. Obtain copies of the bulletin from the company, or —
Circle Inform-A-Gram No. B25.

For Fast, Economical Precision Grinding, use improved Model TML surface grinder. The features are shown and described, and the specifications listed in a new bulletin. Also presented is a detailed drawing of the wheel spindle. The bulletin also covers the Grind-All fixture which provides maximum precision in grinding perforators. Harig Mfg. Corp., 5751 W. Howard St., Chicago 31, will supply copies of the bulletin telling about the TML surface grinder, or —
Circle Inform-A-Gram No. B26.

BOYAR-SCHULTZ CORPORATION
Chicago, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 198

Precision Metal Parts in Large Volume are produced by The Geometric Stamping Co., 1111 E. 200th St., Cleveland 17. A bulletin tells how products can be made better,

faster and at lower cost by converting from castings to stampings. For complete information, the company will provide copies of the bulletin, or
Circle Inform-A-Gram No. B27.

The Multiple Advantages of Lowerator Self-Leveling Work Positioners in solving many different material positioning and handling problems are graphically demonstrated in a new folder. Illustrations show how the top layer of material on the platform of the positioner is always kept at the ideal working/dispensing level. Specifications of all types and models, including dimensions and capacities are given. Copies of the folder are available from American Machine & Foundry Co., Lowerator Div'n, AMF Bldg., 261 Madison Ave., New York 16, or —
Circle Inform-A-Gram No. B28.

Four Sizes of Ram Operated Scrap Choppers are now being produced by Durant Tool Supply Co., 1-15 Thurbers Ave., Providence 5, R. I. Two new scrap choppers, Models M-3 and M-4, will handle material up to 10" and 12" wide and up to 0.100" thick. A circular describes the scrap choppers and also stock straighteners, Shur-Pull die set pullers, and an automatic stock reel.
Circle Inform-A-Gram No. B29.

Hydraulic Power Units and Test Stands are featured in an eight-page brochure issued by J. N. Fauver Co., Inc., 49 W. Hancock, Detroit 1. Standard and special power units are included as well as general purpose test stands and those for special application. The units are pictured and their features listed. In addition, the brochure contains engineering drawings.
Circle Inform-A-Gram No. B30.

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

Michigan

DAVIS TOOL and ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery. Sheet Metal Stampings and Assemblies.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, Ohio.
MU 1-2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, Ohio
WO 1-4736
Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

A. P. SCHRANER & CO.
3338 Payne Ave., Cleveland, O., HEnderson 1-8644. External Cylindrical Lapping Machines. Special Machinery, Tools, Dies, Jigs, Fixtures.

Pennsylvania

MEDAL MANUFACTURING CO.
328 Vine St., Sharon, Pa. Machined parts, complete machine assemblies, special machinery. Send us your prints for quotes.

BUY U. S. SAVINGS BONDS

300% Greater Tool Life

has been obtained in one automotive company's crankshaft dept. using

DRILLMATION AUTOMATION
TAPMATION

Model 1000 D-H
Drilling Machine

12 NECESSARY, *Exclusive* FEATURES IN 1 UNIT

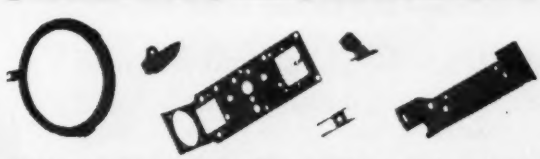
- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
- **THRUST CONTROL** Maximum thrust may be set to protect tools. Will not surge at break point.
- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
- **COOL OPERATION** Low volume high pressure hydraulic pump used on power stroke only. Air power used for rapid traverse.
- **PRODUCTION MACHINE** Mount in any position. Quiet operation. Self lubricating.

DRILLMATION

"FOR THE HOLE FIELD"
DRILLMATION CO.
6500 E. ELEVEN MILE ROAD
CENTER LINE, MICHIGAN
JEfferson 9-2030

CIRCLE INFORM-A-GRAM KEY NO. 1991

STAMPINGS - - - SHORT RUNS



A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

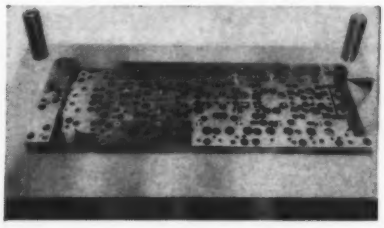
Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1992

Holes

JIG GROUND with *Vulcanaire*

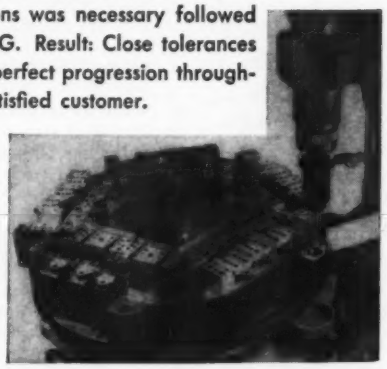
Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

Borrow our Instructive 11 minute movie on Jig Grinding.



A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

741 LORAIN AVE. • DAYTON 10, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2001

The Quick, Easy, Handy Way to TAP BY HAND

. . . Adapts for LATHE USE

THE DAHLSTROM TAP GUIDE virtually eliminates tap breakage—and saves those costly hours spent prying broken taps out of dies. Anyone can use it. Just a few turns of the spindle and the job is done.

Winds through continuously, with no backoff. Work is always dependably straight and square. Fasten it to a post or set it on top of a big job. This handy tapper comes equipped with 9 adapters, 8-32 to ¾" but taps are not furnished. Spindle can be pulled out and used in a lathe, or used as tap extension for hard-to-get-at-places. 13" x 8" x 14", wt. 32 lbs.

Also Makers of Dahlstrom Autostrop and Tap Chuck
Send for bulletin

BRANCH MFG. CO.
16 Olson Drive
NORTH BRANCH, MINN.

Dahlstrom **TAP GUIDE** — $59.50 F.O.B. Factory

CIRCLE INFORM-A-GRAM KEY NO. 2002

Expanding Mandrels

Accuracy 001" - No Distortion
No Slipping - Everlasting

K. O. LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by **Lee** *it's a* **"Knock-Out"**

CIRCLE INFORM-A-GRAM KEY NO. 2003

THE RAPID
A SUPERIOR SWEDISH DRILL CHUCK

- Superior in **Precision**
- Automatic tightening with load
- Easy to open — **No Key** to misplace or cause accidents
- No chewed up tool shanks
- All parts properly hardened and Precision Ground

THE Universal Chuck for high precision machine **AND** mass production

Sole U.S.A. Representative
Karl A. Neise
404 - 4th Ave., New York 16, N. Y., Dept. TP

NEISE MODERN TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 2004

The Fastermatic Automatic Turret Lathe is detailed in Bulletin 1179 released by Gisholt Machine Co., Madison 10, Wis. It is suited for long production runs and can be used economically in job shops where different parts are handled in recurring lots. A maximum number of surfaces can be machined in one chucking using single or multiple tools mounted on the six turret faces and the independent front and rear cross slides. The bulletin details the features of the lathe and lists specifications.
Circle Inform-A-Gram No. B31.

An Improved Line of Pantograph Engraving Machines and Accessory Items is described in Catalog 57 from Mico Instrument Co., 80 Trowbridge St., Cambridge 38, Mass. Included are a cutter grinder, name plate edging machine, sensitive drill press and hand tapping machine. For complete information, obtain a copy of the catalog by writing to the company, or —
Circle Inform-A-Gram No. B32.

Unusual Tracer Sensitivity and Accuracy are provided by the Rockford tracer-lathe with Kopy-Kat duplicator. A bulletin describes and illustrates the features of the tracer-lathe that will do repetitive tracing to thousandths. In addition, the specifications are listed. For complete details, obtain a copy of the bulletin from Rockford Machine Tool Co., Rockford, Ill., or —
Circle Inform-A-Gram No. B33.

Complete Descriptions, Specifications and list prices of Fastcut tools are given in a 36-page catalog announced by Fastcut Tool Co., 7405 E. Davison, Detroit 7. Included are N-Mills, Woodruff keyseat cutters,

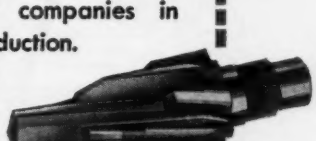
center reamers, and combined drills and countersinks. For your copy of the catalog, contact the company, or—**Circle Inform-A-Gram No. B34.**

An Increased Work Range and Greater Work Capacity are features of a new line of ram type milling machines. In addition, these machines reduce idle machine and operator time and provide more workability and cutability. An adjustable cutterhead permits horizontal, vertical and angular milling, all without attachments. For details on the machines and their specifications, obtain a catalog from Van Norman Machine Co., Springfield, Mass., or —
Circle Inform-A-Gram No. B35.

Locate and Pierce Holes in Large Metal Sheets and Plates in One Handling with heavy duty turret punch presses. They are equipped with a direct measuring gage and table. A bulletin includes specifications and detailed information on the features and operating principles of these 40 to 150 ton capacity machines. Direct requests for copies of Bulletin 500DM to Wiedemann Machine Co., Dept. 506, 4272 Wissahickon Ave., P. O. Box 6794, Philadelphia 32, or —
Circle Inform-A-Gram No. B36.

FINE CUTTING TOOLS by Eclipse

Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.



- High Speed Steel Cutters
- Carbide Tipped Cutters
- Core Drills
- Inserted Blade Cutters
- Multi-Diameters
- Back Spotfacers

and remember . . .

Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.

- Write for Counterbore Cat. No. 51
- Write for End Mill Cat. No. 56

ECLIPSE COUNTERBORE COMPANY
DETROIT 20, MICHIGAN
END MILL DIVISION—NORTH BRANCH, N. J. ADDRESS (BOX 97, RARITAN N. J.)

CIRCLE INFORM-A-GRAM KEY NO. 201

The New Red Ring Gear Honing Process is described in Bulletin H-57-2 now available from National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13. The economies of the process are discussed as well as the features and applications. Recommended practice for applying the process is outlined in detail. In addition, GHB gear honing machine is covered complete with specification tables.
Circle Inform-A-Gram No. B37.

A Hand Traveling Crane which is available in 3 to 10 ton capacities is the subject of Bulletin DH-459A from American Chain & Cable Co., Inc., Wright Hoist Div'n, York, Pa. Model B-47 is used for many industrial applications where spotting of load is more important than fast travel speed. The bulletin contains data on construction details, weights and dimensions. Get your copy from the company, or —
Circle Inform-A-Gram No. B38.

WICKMAN-BROWN *Fully Floating*
MICROMETER ADJUSTABLE REAMERS

Typical Applications:
- LATHES • TURRET LATHES
- MULTI SPINDLE AUTOMATICS
- CHUCKING MACHINES
- SINGLE SPINDLE AUTOMATICS
- VERTICAL AND HORIZONTAL BORING MILLS
- JIG BORERS
- GENERAL TOOL & DIE ROOM AND SHOP MAINTENANCE

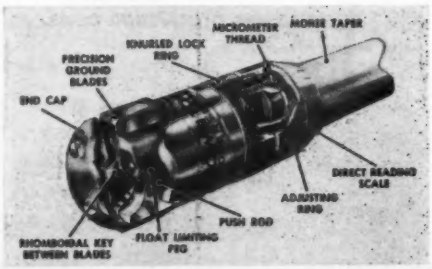
Type S for through hole reaming.
Type SL for blind hole reaming.
Range in Sizes: ¾" to 8" in only 18 units

Type SO for through hole reaming only—range from ½" to ¾" in ONLY 5 Sizes.

• The initial cost of a Wickman-Brown reamer is your last major expenditure. The blades, available in both high speed steel and tungsten carbide, are precision ground and may be sharpened repeatedly without affecting micrometer reading.

Eliminates costly floating tool holders by built-in positive and predetermined float.

Down time is eliminated on production due to micrometer adjustability without removal of blades or unit from machine.

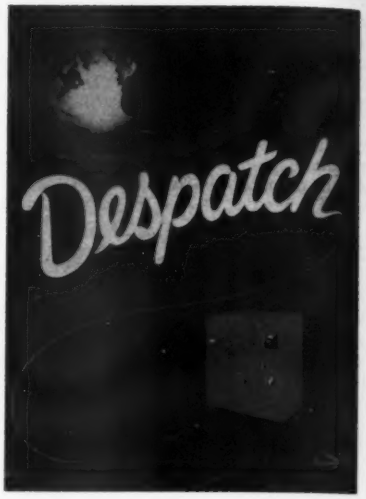


Distributors' Inquiries Invited

THE Wickman MANUFACTURING CO.
10329 CAPITAL AVENUE (OAK PARK)
DETROIT 37, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 202

Laboratory and Production Ovens are the subject of Bulletin 100 prepared by Despatch Oven Co., 619 S.E. 8th St., Minneapolis 14. Each oven is shown, described and its features and applications noted. Also



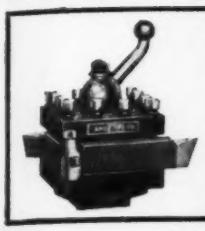
included are floor plans and a table of specifications. For complete information, request a copy of the catalog from the company, or —
Circle Inform-A-Gram No. B39.

"Rexarc Engineered Toughness" is a 20-page manual on Rexarc hard-facing and manganese electrodes. A comprehensive procedure section illustrates many typical build-up and hard-facing applications for better wear resistance. Recommended application procedures are shown, together with the type and quantity of material required, and the range of machine settings for each. In addition, a directory of uses is included. The Sight Feed Generator Co., W. Alexandria, O., will provide copies of the manual, Form 2057, or
Circle Inform-A-Gram No. B40.

Machinery Lighting for punch and drill presses, boring mills and various rotary spindle machines is featured in Bulletin 156 released by Sun-Lite Mfg. Co., 2555 Bellevue, Detroit 7. The various types of press lighting equipment are shown and described. In addition, the features and specifications are listed. The company will make available copies of the bulletin with details, or —
Circle Inform-A-Gram No. B41.

A Newly Developed Interference Microscope serves as a surface finish tester for highly polished surfaces with roughness heights of approximately one micron or less. The Carl Zeiss Jena microscope is designed for convex spherical and cylindrical surfaces. For further details, obtain a bulletin from Ercona Corp., 551 - 5th Ave., New York 17, or —
Circle Inform-A-Gram No. B42.

Enco Turrets Assure ±.0005" Accuracy



by being on the ball!

Enco's passion for exacting accuracy is paying off in metal working operations everywhere! Combining precision lathe output with efficiency and economy has become a necessity . . . and Enco turrets have proved the ideal answer. An Enco turret transforms one lathe into a production machine, each operation of unsurpassed accuracy due to *spring loaded ball design!*

Spring loaded balls give you the accuracy you want! Hardened steel precision balls locked between accurately milled spherical seats consistently give accuracy in re-indexing. Hardened all steel construction minimizes wear, retains built in precision.

Write today for catalog No. 53. There's an ENCO turret for every lathe.

ENCO

Manufacturing Company, 4520 W. Fullerton Ave.

Chicago 39, Ill., Dept. 757

CIRCLE INFORM-A-GRAM KEY NO. 2031

COMPLETE THE DIE-SET AT YOUR BENCH

Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
726 Union Avenue Bridgeport 7, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 2032

Tomco

HAND WHEELS
HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
SPECIALTIES

Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications

For original equipment or replacement parts look to Tomco for quality and service.

Write for literature

Tomco PRODUCTS CO.

1623 DOUGLAS AVE.
RACINE, WISCONSIN

Blank or Machined—from stock

CIRCLE INFORM-A-GRAM KEY NO. 2033

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

HORIZONTAL

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request

A few desirable distributor territories still available.

WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2034

most VERSATILE PIN GAGES *made!*

Horberg exclusive taper feature lets you check undersize, oversize and odd-size holes, slots, etc., quickly and accurately with standard letter, number or drill-size gages.

A precision concentric taper on the lower half of each gage runs to 0.0012" smaller than gage size. You get a continuously accurate range of measurement with each gage, for quicker, handier, precision gaging in set-up, machining, tooling and inspection operations.

SPECIFICATIONS

Diameter accurate to +0.0001" —0.0000"
Standard 1.5" length
Concentric taper on lower half to .0012" smaller size
Oil hardened tool steel

PRICES AND ORDER FORM (F.O.B. Bridgeport, Conn.)

_____Letter sets—52 gages
A-Z in pairs $65.00
_____Fraction sets—60 gages
3/64" to 1/2" in pairs $75.00
_____Number sets—120 gages
1-60 in pairs $130.00
_____Single gages_____size
ea. $1.50

Sets furnished in indexed plastic case. Extra case $15.00
Prices subject to change without notice.

Please rush items checked to:

Name_____

Company_____

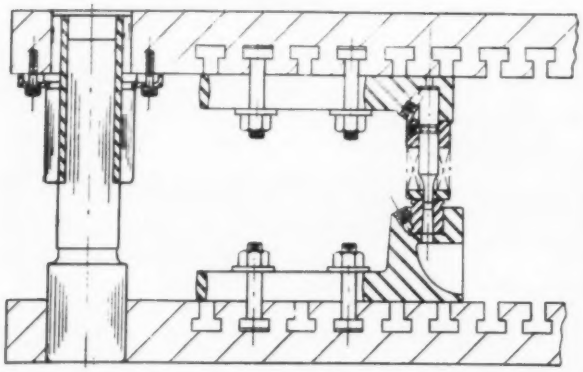
Address_____

Horberg GAGE COMPANY 29 Staples St., Bridgeport, Conn.

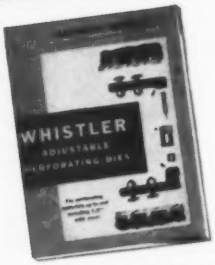
CIRCLE INFORM-A-GRAM KEY NO. 2035

ADJUSTABLE DIES by WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.



YOU NEED THIS CATALOG

to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
748 Military Road, Buffalo 23, N.Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

1957 — Our 40th Year Manufacturing Dies
CIRCLE INFORM-A-GRAM KEY NO. 2041

UNMATCHED **Repeatability** WITH

Em-re **DIAL INDICATORS**

THE ONLY
100% SHOCKPROOF DESIGN

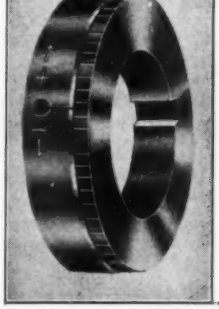
Patents Pending.

There's never been a dial indicator like the "Em-re." It combines a new and greatly simplified design with a fully jeweled gear mechanism that is indestructible. As a result it gives you readings of previously unobtainable accuracy — accuracy that will repeat itself without deviation through millions of measurements. "Em-re" .00005" and .0001" models, for example, provide repeated readings to an accuracy of better than .00002". And the *completely* shockproof "Em-re" system preserves and *actually contributes to* this repeatability over a lifetime of service. Stocked in 26 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". *Also available for accurate indicator testing — the "Master" Dial Indicator Checker.*

Write for Catalog **E.**

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2042



MILLING MACHINE SPACING COLLARS

SAVE TIME

ON GANG MILLING SET - UPS

These MICROMETER ADJUSTABLE SPACING COLLARS are designed for accurate spacing of side milling cutters, gang milling and various other multiple setups on milling machines. Accurate spacing of the milling cutters is easily made by merely loosening the cutter arbor nut and making a plus or minus adjustment.

You will be assured of a QUICK, ACCURATE and POSITIVE ADJUSTMENT at all times.

For immediate delivery specify size and mail orders to . . . . . .

Size of Cutter Arbor	Maximum Outside Diameter	Price
⅜	1-9/16	$12.75
1	1-13/16	12.75
1¼	2-1/16	13.25
1½	2-7/16	13.25
1¾	2-3/4	16.75
2	3-1/16	19.50

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINN.

CIRCLE INFORM-A-GRAM KEY NO. 2043

"Now You Can Step Ahead in the Toolroom." This folder details Stentor, an oil-hardening, non-deforming tool steel, with a hardening range of 1425°F to 1525°F. Stentor features freedom from decarburization, minimum size change, uniform hardenability, and elimination of the preheating required for many other tool and die steels. Its applications include dies for blanking, forming, molding, laminating and trimming; broaches; collets; stamps; spindles; master taps; and thread gages. Copies of the folder are made available by The Carpenter Steel Co., 101 W. Bern St., Reading, Pa., or — **Circle Inform-A-Gram No. B43.**

Measure, Troubleshoot and Balance Out Vibrations caused by rotating parts and assemblies with two lightweight model vibration analyzers. Model 300 is intended primarily for "in place" and production balancing while Model 400 incorporates features for analyzing or troubleshooting as well. At maximum sensitivity both models have a full-scale displacement range of 0.001". A bulletin detailing the analyzers and describing their operation and application possibilities can be had by writing to International Research & Development Corp., 797 Thomas Lane, Columbus, O., or — **Circle Inform-A-Gram No. B44.**

Rota-Master Brushes are highlighted in a folder prepared by The Osborn Mfg. Co., Cleveland 14. These brushes of open face construction are made in 16", 18" and 24" face widths. They are used for cleaning rubber or fabric conveyor belts, material

spreading, dust removal and metal finishing when used with abrasive compounds. The folder contains brush specifications, horsepower and machinery requirements and a drawing illustrating method of setup. **Circle Inform-A-Gram No. B45.**

The Complete Line of Milling Heads and Adjustable Taps with ground thread chasers produced by The National Acme Co., Cleveland 8, are covered in Catalog DT-52. Vers-O-Tool threading and hollow milling heads and Namco collapsible and solid adjustable taps are illustrated and described in detail. Also contained in the catalog are threading machines. See the catalog prepared by the company for complete details, or **Circle Inform-A-Gram No. B46.**

Automated Techniques for High Speed Blast Cleaning are presented in 20-page Bulletin 703 offered by Pangborn Corp., Hagerstown, Md. Covered are the construction features of Rotoblast units, layout aids, and a special section on abrasive coverage. Also given are complete specifications and dimensions for Blastmaster barrels. Dimensional plan views and silhouette drawings of all machines are included. **Circle Inform-A-Gram No. B47.**

J&L

COLLAPSIBLE TAPS

Lop off expense of inventory because:

- Only one tap with five extra bodies gives a range of 1 5/16" to 3 1/2"
- All shanks are interchangeable
- They can be used either as stationary or rotary types

Changeover time — less than 10 minutes

For full information on J&L Thread Tool Products . . .

Automatic Opening Die Heads & Chasers
Automatic Opening Collapsible Taps
Solid Adjustable Taps
Automatic Opening Stud Setters
Modern-Magic Chucks & Collets
A Complete Line of Accessories

. . . send for this free book

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, 519 Clinton St., Springfield, Vt., U.S.A.

Class III Guaranteed Not Sometimes, but Everytime!

THREAD TOOL DIV.

CIRCLE INFORM-A-GRAM KEY NO. 205

The Proper Procedure for Handling without Pallets is pictorially described in Bulletin 2117 from The Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15. Detailed is the Push-Pull loader with integral sideshift. In addition, the bulletin gives complete specifications on the attachment which can be fitted to any Yale industrial lift truck. The company will provide copies of the bulletin, or —
Circle Inform-A-Gram No. B48.

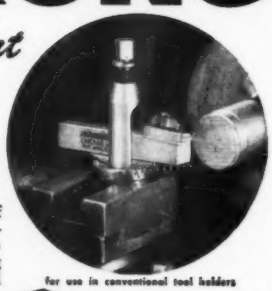
Reduce Material Wastage and Machining Time with the Burns Style taper lock master feeder. It is illustrated and described in Bulletin 50 recently released by Sutton Tool Co., Sturgis, Mich. The device feeds both hot rolled and cold finished stock to Acme-Gridley, Cone, Greenlee, Gridley and New Britain screw machines. The taper lock design is detailed complete with cross-section view and illustrations.
Circle Inform-A-Gram No. B49.

ARMSTRONG

Carbide Insert

TOOL HOLDERS

for use in clamp type rests



for use in conventional tool holders

Right Hand Square Insert
Left Hand Square Insert
Left Hand Square Insert
Right Hand Square Insert
Right Hand Triangular Insert
Left Hand Triangular Insert
Left Hand Triangular Insert
Right Hand Triangular Insert

The ARMSTRONG System of Tool Holders gives the advantages of (NO GRINDING) "throw-away" insert tooling for all metal turning—for tool room, machine shop and maintenance lathes as well as for production machine tools. Included in the Armstrong System are ARMSTRONG Carbide Insert Tool Holders with shanks to fit in conventional tool posts and for clamp rests of all sorts. Both types are provided in a wide range of sizes to hold either "square" or "triangular" carbide inserts. Both types come in right-hand or left-hand styles. For Carbide Insert Tool Holders exactly suited for a specific need or piece of equipment, standardize on ARMSTRONG Tools.

Special ARMSTRONG design features include: (1) Fast convenient clamping which permits rapid indexing of inserts, (2) replaceable hardened tool steel seat ground to provide a flat base for inserts, (3) accurately machined heat treated alloy steel shanks for extra strength and rigidity.

Because ARMSTRONG Armide Inserts as well as ARMSTRONG Carbide Insert TOOL HOLDERS are carried in stock by leading Industrial Distributors they are as available as your telephone—single tool sets or a selection of sizes.

Write for catalog sheets.

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.
5220 W. ARMSTRONG AVE. • CHICAGO 30, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 206

Tormag Magnetic Drives are the subject of Bulletin W-T 1-57 announced by Whitney Chain Co., 237 Hamilton St., Hartford 2, Conn. Included are data on design, drive features, operating and performance curves, output torque rating-dimensions, selection charts and photos of installations and applications.

Circle Inform-A-Gram No. B50.

Tubing, Production Processing and Facilities for handling a wide variety of tubing requirements are described in a new booklet from Copperweld Steel Co., Ohio Seamless Tube Div'n, Shelby, O. A fold-out flow chart shows the tube-producing process, and in-plant photos and brief descriptions present the sequence of operations involved. Separate sections on mechanical seamless carbon or alloy tubing, aircraft seamless tubing and electric resistance welded tubing include applications and maximum size range tables.
Circle Inform-A-Gram No. B51.

Complete Data on how a Superior hydraulic press brake solved a tough production job is given in a performance report, the first of a series. Two large photos show details of the front and rear construction. In addition, features and advantages of the machine are noted. For copies of the report, contact Superior Machine Co., 1389 Heistan Pl., Memphis 4, Tenn., or —
Circle Inform-A-Gram No. B52.

Internal Rotofinishers for finishing or polishing tubes and cylinders are covered in an abrasive products catalog from Field Abrasive Mfg. Co., Inc., 1303 Stanley Ave., Dayton 4, O. Also included in the catalog are cartridge rolls, abrasive spirals, bands, discs, wheels, mandrel mounted wheels and mandrels. One section is devoted to miscellaneous products. Each item is shown and described.
Circle Inform-A-Gram No. B53.

TICKLISH FINISHING JOB?
do it better with a Paramount Felt Bob

If you have a tough polishing, buffing, lapping or de-burring finishing problem where tolerances must be held close, solve it by putting a Paramount Bob on the job. Seven custom shapes, 42 sizes, four degrees of hardness from soft to rock hard — there's a Paramount Bob ideal for every close-quarters precision finishing job. For example:

MICRO-FINISHING

Paramount Felt Bobs make ultra-fine finishing of surfaces quick, easy and economical.

DIE AND MOLD MAKING

Thousands of die and mold makers depend on Paramount Bobs to perform precision finishing and buffing operations. Ideal for removing burrs without destroying close tolerances.

NEW BOB ASSORTMENT KITS

K-1 Assortment includes 24 mandrel mounted bobs, 36 small wheels, touch-up pads — 66 pieces all together — packaged in one convenient bench top box. (K-2 Assortment also includes four sticks assorted polishing compounds.)

These handy assortments provide bobs of just the size, shape and hardness you want — and at $10.95 (K-1) and $12.95 (K-2) they are far below the cost of buying bobs separately.

See your jobber or write for literature

BACON FELT CO. — **JOBBER INQUIRIES INVITED**

467 West Water St., Taunton, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 2071

CYCLONE SEPARATION

FOR MORE EFFICIENT DUST COLLECTION —FILTERS LAST LONGER

Almost all industrial dusts can be collected more efficiently by Dustkop. Thirty-seven standard models *ready to use!* Reduce installation costs — save space. Write for descriptive literature.

ALSO A COMPLETE LINE OF MIST COLLECTORS

DUSTKOP STOPS DUST

AGET MANUFACTURING COMPANY
1394 EAST CHURCH ST., ADRIAN, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2072

D-R SMALL LOT STAMPING
FROM TEMPORARY TOOLS

SOLVES A TOUGH COST PROBLEM

Converting from a casting to a sheet steel stamping reduced this customer's cost to one-tenth his old method.

Only 200 piece parts/year were needed, and an annual design change was a further possibility.

Dayton Rogers produced 100 pieces for less than the cost of the tool steel used in making a conventional die for such a part, *with superior results.*

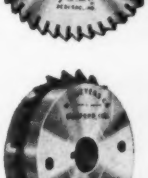
GOT A DESIGN-ENGINEERING PROBLEM? SEND YOUR SKETCH, BLUEPRINT OR PART, PLUS QUANTITY, FOR PROMPT QUOTATION

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINNESOTA

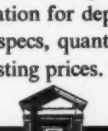
CIRCLE INFORM-A-GRAM KEY NO. 2073

PRECISION CUTTERS!



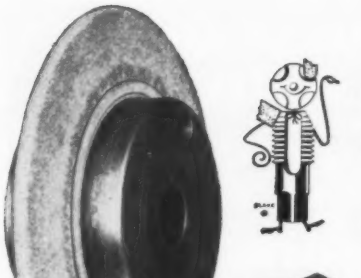
MADE TO YOUR EXACT SPECS... SOLID CARBIDE, OR CARBIDE TIPPED!

Why put up with stock cutters, when made-to-order cutters cost no more? Cutters designed for specific gang-milling, slotting, venting, slitting or grooving operations in various diameters and thickness to suit YOUR needs exactly. Fast service: all component materials carried in stock. Top-flight reputation for dependability built since 1888. Furnish complete specs, quantities desired and material to be cut when requesting prices. Write for Bulletin No. 51



W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 2074



For Profitable Tapping, Grind Your OWN Best Rake Angles!

Controlled grinding of tap flutes and chamfers.

For each different material, there is a "best" rake or hook angle for tapping. You can grind and re-grind this angle on taps for each of your jobs . . . positively and accurately, time after time . . . with the BLAKE Flute Grinder.*

Combined with the BLAKE Chamfer Grinder, this machine can give you substantial savings even with Class 3 or 4 fit standards, because you will have:

1. Best rake or hook angle for the material tapped.
2. Exact indexing of cutting edges.
3. Correct spiral points.
4. Accurately relieved chamfers.

The increased uniformity and accuracy of your threads, plus *far* greater tap life, are the sound basis for maximum savings in your tapping costs.

Ask us for the details of what this combination can do for you.

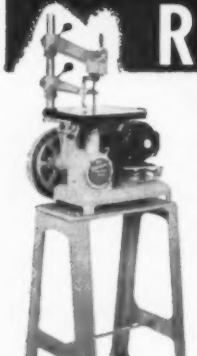
**Now available with air operated vertical slide.*

EDWARD BLAKE COMPANY INC.
MANUFACTURERS OF FLUTE AND CHAMFER GRINDERS
442 CHERRY ST., WEST NEWTON 65, MASS.
Exclusive Distributors of:
BLACK DIAMOND PRECISION DRILL GRINDERS • SURFACE FINISH STANDARDS • WORCESTER DRILL GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 2081

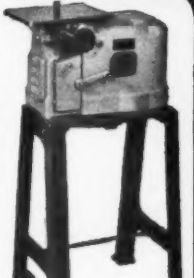
Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE



DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.



PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

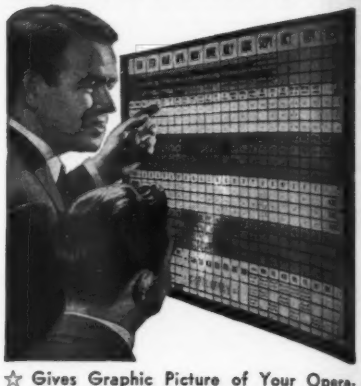
Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

Write for Illustrated Bulletins and Prices

RICE PUMP & MACHINE COMPANY
228 PARK AVENUE BELGIUM, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 2082

You Get Things Done With Boardmaster Visual Control



- ☆ Gives Graphic Picture of Your Operations—Spotlighted by Color
- ☆ Facts at a glance—Saves Time, Saves Money, Prevents Errors
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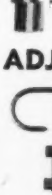
CIRCLE INFORM-A-GRAM KEY NO. 2083

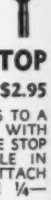
.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

$2.50 NEW POSTPAID except C.O.D. **$10.00 DELUXE**



- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.
- NEW .500 DIA. MODEL FOR LARGER WORK ONLY.



.200 Dia.

ADJUSTABLE VISE STOP

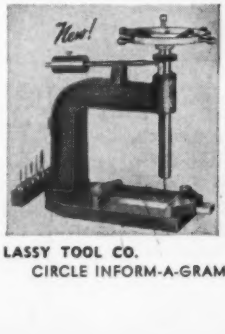
$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

Dealer Inquiries Invited

GLOVER MFG. CO.
422 Park Ave. Meadville, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 2084



LASSY
SUPERSENSITIVE HAND TAPPER

New exclusive features and top quality make Lassy Tappers outstandingly the finest available. Write for illustrated circular showing 3 models, and also Universal Tap and Die Guide.

LASSY TOOL CO. Plainville, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 2085

Automatic Transverse Spray Finishing Machines are highlighted in an illustrated catalog from The DeVilbiss Co., Toledo 1, O. Models and specifications of the horizontal and vertical straight line types are included, as well as typical uses. Contour machines in both types, which are built to order, are described. Copies of the catalog can be obtained from the company, or —
Circle Inform-A-Gram No. B54.

Save on Assembly, Grinding Time and Diamond Wheel Wear with Type SF end mills. One cutter body can be used for milling numerous metals. The SF end mills make it easy to maintain diameters and provide minimum maintenance. For details and specifications, get a copy of Bulletin 101 put out by Lovejoy Tool Co., Inc., Springfield, Vt., or —
Circle Inform-A-Gram No. B55.

Descriptions and Illustrations of Press Room Equipment are contained in 16-page Catalog 571 now available from Sesco Inc., 8881 Central Ave., Detroit 4. Featured is the patented hydraulic system incorporated in the equipment, which is used for handling coil stock, whether it is steel, stainless steel, aluminum, brass or other material. The company will supply copies of the catalog, or —
Circle Inform-A-Gram No. B56.

Turret Tool Posts with Clamping Type Handle are the subject of an eight-page bulletin. The new clamping type handle assures positive locking and withstands vibration even when handling interrupted cuts, or the fast feeds and speeds of

heavy duty production lathes. Three styles and 11 sizes are available to mount in the T-slot of the compound rest or the bolt circle of the main slide of an engine lathe. For details, see Bulletin 19-T provided by McCrosky Tool Corp., Meadville, Pa., or—**Circle Inform-A-Gram No. B57.**

Final-Finish New Forging Dies with a liquid honing machine. It also cleans and refinishes used forging dies for longer life and longer production runs. A bulletin discusses the machine, presenting a typical case history. In addition, it lists the advantages of liquid honing forging dies. For details, see V-B Brief, Vol. 4, No. 1, put out by The Vapor Blast Mfg. Co., 3131 W. Atkinson Ave., Milwaukee 16, or —
Circle Inform-A-Gram No. B58.

Designed for Rapid Production Marking is Model 79 shell marking and knurling machine. It is also used for knurling on the periphery of a shell body or rotating band from 20 mm to 8" dia. Up to 40 shells/min can be automatically or manually fed to the machine. The machine's operation, specifications and details are found in Bulletin 146-C10, which is provided by Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh 13, or—**Circle Inform-A-Gram No. B59.**

STANDARD HEAVY DUTY SUPER PRECISION SPINDLES
"Masters of Milling"

From 1 to 200 HP with standard tapers, #20 to #60. To satisfy every milling demand — enclosed, totally enclosed fan-cooled, high cycle and liquid-cooled. Motorized or Belt-Driven. Variable, single or multiple speed motor — Speed to suit your application.

AMERICA'S MOST EXTENSIVE LINE OF MILLING SPINDLES!

A milling spindle for every purpose . . . and more than that . . . a milling spindle reflecting in its SUPER CAPACITY AND TROUBLE FREE OPERATION the four decades of its maker's experience in spindle manufacturing. And "special problems"? . . . get the answer from Standard experts!

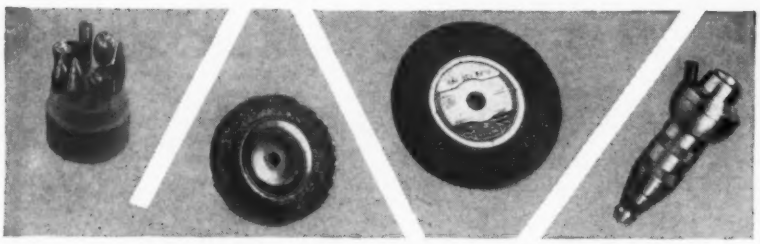
FOR COMPLETE SPECIFICATIONS AND DIMENSION DRAWINGS OF MORE THAN 75 MILLING SPINDLES, WRITE TODAY!

SUPER PRECISION SPINDLE DIVISION
the STANDARD electrical tool co. SINCE 1912
STANDARD SETS THE PACE!
HALLMARK OF METALWORKING THROUGHOUT THE WORLD
MT. HOPE AND SIXTH ST. • CINCINNATI 4, OHIO

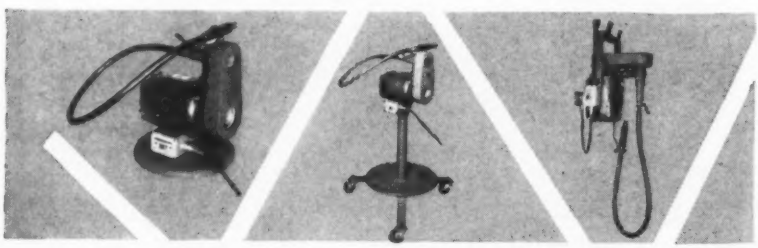
CIRCLE INFORM-A-GRAM KEY NO. 209

Two Principal Types of Magnetizers are discussed in Bulletin 17 from The Indiana Steel Products Co., Valparaiso, Ind. Covered are the electromagnetic and the permanent-magnet types. They permit optimum magnetic results where the magnet can be magnetized after assembly with associated parts of the magnet circuit. They also permit magnetization at or near end of assembly operation. Included is data, charts, photos and directions on how to use the magnets.
Circle Inform-A-Gram No. B60.

Cold Forming of Steel Bars by the Republic Die-Form Process is detailed in a four-page folder. The process is a new method for cold reduction of steel bars into multi-diameter shaft blanks ready for finish turning or grinding. Drawings and photos illustrate the process and some of its applications. Also noted are the principal advantages of the process. Republic Steel Corp., Advt. Div'n, 3100 E. 45th St., Cleveland 27, will supply copies of the folder, Form ADV-746, or —
Circle Inform-A-Gram No. B61.



everything you need



from start to finish

Remember, when you're checking specifications and selecting equipment, don't fail to consider Haskins flexible shaft machines and accessories. Haskins' complete line of equipment insures faultless performance on your *special* and *standard* metal-working operations *—without interruptions.*

Whether you're grinding, wire-brushing, filing, whatever the job, a start with Haskins will carry you through from the beginning right down to a perfect finish. Our three models, bench, pedestal and suspended mounts, plus a multiplicity of metal-working tools, enable you to achieve faster production, lower labor costs and a superior finished part! Find out about the versatile line of Haskins flexible shaft machines and accessories—*leaders in their field for over 30 years.*

Write Today for a Catalog and Literature

HASKINS

R. G. HASKINS Co.

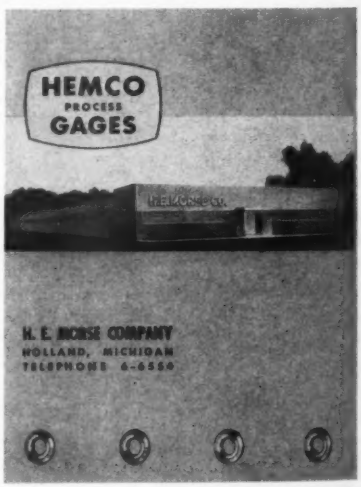
605 S. Washtenaw Chicago 12, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 210

A General Catalog has been published by Precise Products Corp., Racine, Wis. Covered are grinder millers, power quills, milling machines and accessories, and speed

lathes. Also included in the catalog are high speed drill presses, machine mounts and filtration units. For further details, get Catalog FGH-3 from the company, or —
Circle Inform-A-Gram No. B62.

Gage Ordering Data is contained in a catalog from H. E. Morse Co., Holland, Mich. Covered are six classes of cylindrical plug gages; cylindrical ring, plug thread, reversible plug thread, ring thread, truncated

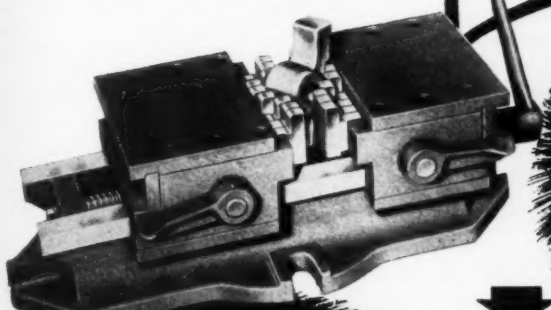


setting plug, and pipe thread gages; master setting discs; thread measuring wires; and special type gages. The catalog explains the 3-wire measurement system. Also presented are tables of decimal equivalents and tolerances, and a section on the company's gage salvage program.
Circle Inform-A-Gram No. B63.

NEW

Contour Gripping FIXTURE

SAVES YOU MONEY!



CUTS SPECIAL FIXTURE COSTS

INSTANTLY GRIPS AND HOLDS ANY ODD SHAPED PIECE

TAKE BIGGER CUTS

- FASTER
- SAFER
- CHEAPER

THOUSANDS OF USES

This amazing fixture holds any shape in any position . . . for drilling, milling, shaping or grinding. It only has to be set once to take identical pieces for any operation on all types of machine tools.

Investigate its possible application in your business. Write for further details or demonstration.

NO MORE BLOCKING SHIMMING HOLDS ANY SHAPE IN ANY POSITION

WRITE for Further Information Today

Act Now!

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CIRCLE INFORM-A-GRAM KEY NO. 2111

Monarch Precision SHAPLANE Radius Tools

Illustration shows convex cutter for ¼" to 2½" balls.

FIVE MODELS for LATHES, SHAPERS, PLANERS, BORING MILLS

Range ½" to 3" for concave Radii. Also heavy duty models for radii to 6" on planers, etc.

PATENT PENDING

Write for circular

C. B. TEETER, TOOL ROOM SPECIALTIES

4470 Oakenwald Ave., Chicago 15, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2112

The "MASTER COMPAR"

INDICATING MICROMETER COMPARATOR

has the VISIBLE feel

No Arguments as to correctness of reading due to "feel"

Use it as Comparator, Master Micrometer, Go & No Go Gage.

1" Range reading in 1/10,000"

To attain permanent accuracy at these close limits, highest precision workmanship and exclusive design of mechanism are of Major importance and ONLY found in "MASTER COMPAR"

A RIGHT HAND TOOL

Release button for movable Anvils on RIGHT Hand side enables you to hold tool the conventional way.

NEW — Resetting to Zero in 5 seconds

Quick adjustable tolerance bands. Heavy TUNGSTEN CARBIDE Anvils will actually measure Out-of-Roundness, Ovalness and Taper.

0-1" SIZE IN HARDWOOD CASE

$105

Also Available in LARGER SIZES

Ask for Illustrated Circular — Code GIOFF

Sold thru Tool Supply Houses

Ask for Demonstration

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CIRCLE INFORM-A-GRAM KEY NO. 2113

buy **PEM** Drill Bushings out of Template Production Savings

1. One hole compression-mounting positively locks self-clinching bushings into template metal—in one operation.
2. Save more than their cost by simplifying template assembly. No riveting, welding, indexing, nesting, no outboard supports.
3. High torque and pull-out resistance.
4. Alignment and center distances secured, automatically.
5. Permit thin gauge, light weight templates.

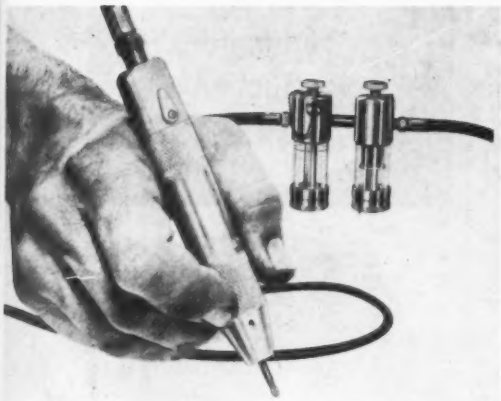
Write for literature and samples for test. Penn Engineering & Manufacturing Corp., Doylestown, Pa.

PEM

CIRCLE INFORM-A-GRAM KEY NO. 2114

PRODUCTS

NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS

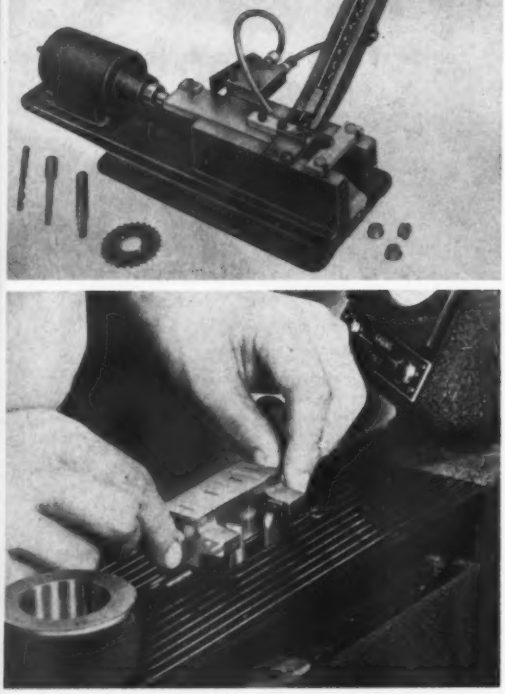


PENCIL-SIZE GRINDER

Grinding, deburring, cutting, polishing, die and mold finishing and engraving operations are performed by Model GA-125 pencil-size grinder. It operates at 100,000 rpm at 80 lbs psi air pressure. The Bellows Co., Akron 9, O., or — **Circle No. A1.**

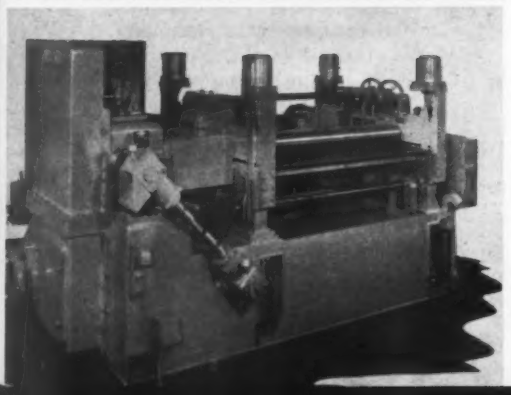
WORK FEEDER . . .

This improved Model 43 work feeder features a single-acting air cylinder which takes a larger diameter return spring for longer spring life and more uniform tension. The Oilite bearing surface has been increased to provide more accurate alignment of the ram. Mead Specialties Co., Dept. WF-59, 4114 N. Knox Ave., Chicago 41, or — **Circle No. A2.**



GAGE BLOCKS . . .

Minus-nothing tolerances for all its standard gage blocks have been adopted by Dearborn Gage Co., Ellstrom Standards Div'n, Dearborn, Mich. They insure finer accuracy and longer gage block life. Shown are the gage blocks being used in setting an internal measuring machine. **Circle No. A3.**

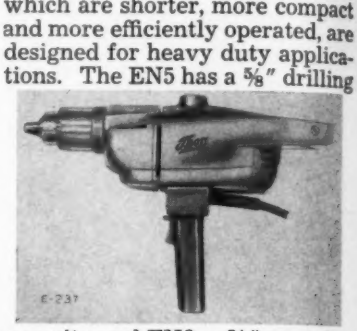


PRESS FEEDER . . .

A mechanically-controlled automatic feed line for blanking or progressive die presses has been designed by McKay Machine Co., Youngstown 1, O. It will feed lengths as long as 60″ of 0.125″ by 60″ wide stock. Strip flatness can be controlled by adjusting the built-in roller leveler. **Circle No. A4.**

ELECTRIC DRILL . . .

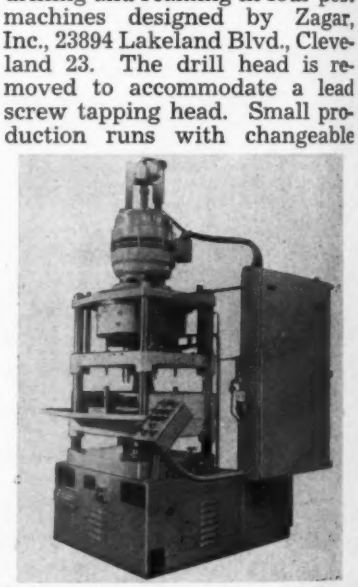
The Silver Line drills in the EN Series weigh less but pack more power. They supersede the UF Series. The new drills, which are shorter, more compact and more efficiently operated, are designed for heavy duty applications. The EN5 has a ⅝″ drilling



capacity and EN6, a ¾″ capacity. The two larger models, EN7 and EN8, have drilling capacities of ⅞″ and 1″ respectively. Speed range is from 430 rpm for the smallest models to 300 rpm for the 1″ drill. Thor Power Tool Co., Aurora, Ill., or — **Circle Inform-A-Gram No. A5.**

TAPPING AND DRILLING MACHINE . . .

Tapping is combined with drilling and reaming in four-post machines designed by Zagar, Inc., 23894 Lakeland Blvd., Cleveland 23. The drill head is removed to accommodate a lead screw tapping head. Small production runs with changeable



hole patterns, as well as various operations, can be economically tooled. The four-post principle involves a hydraulically-actuated ram which raises the work and feeds it into the rotating spindles of the head. All holes are machined simultaneously. **Circle Inform-A-Gram No. A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

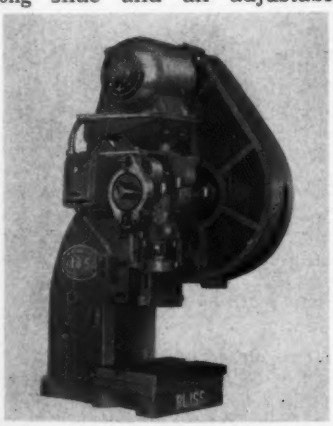
LEVELING JACK . . .

Easy leveling of machine tools, assembly fixtures, surface plates and other industrial equipment is possible with Style JS leveling jack. It safely supports up to 20 tons and raises and lowers easily by means of the adjustable nut. Compensation for floor slope is

made by the concave spherical radius in the lift screw and aligning disc. Machine vibration and creepage are minimized through the use of special mounting pads, eliminating the need for anchor bolts on many installations. The jack is available in 12 models. Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit 12, or **Circle Inform-A-Gram No. A7.**

BENCH PRESS . . .

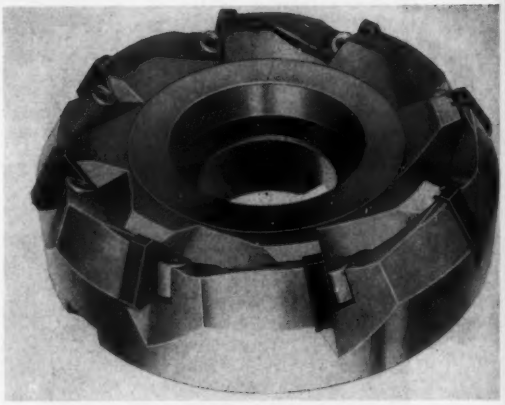
The capacity of this press is 10 tons. Model 18S and others in its line were developed for the light metalworking, electronic and electrical industries. It features a rolling key clutch, an extra long slide and an adjustable



brake. Model 18S bench press is particularly useful on comparatively small work, permitting high speeds with and without the use of automatic feeds and devices. E. W. Bliss Co., Canton, O., or — **Circle No. A8.**

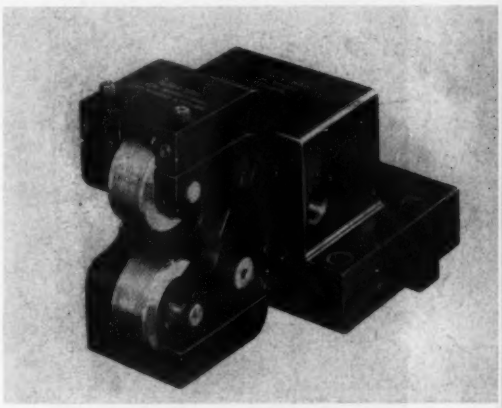
MILLING CUTTER . . .

Used in high speed milling with NP Throway carbide inserts is the RC milling cutter available in four styles. Its indexing procedure assures rapid removal of worn insert and indexing to a new cutting edge. There are no threads in the body to strip when indexing the insert. Newcomer Products, Inc., Latrobe, Pa., or — **Circle No. A9.**



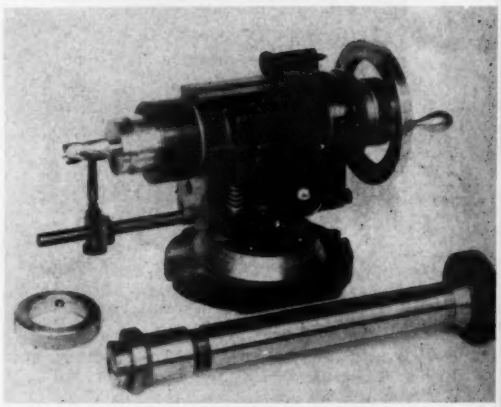
THREAD ROLLING ATTACHMENT . . .

The Precision-Rol attachment rolls high precision, close tolerance uniform threads, right or left hand, on automatic screw machines or turret lathes, at mass production rates. It can also be used to roll annular or helical grooves, etc., and for knurling and burnishing. The Sheffield Corp., Dayton 1, O., or — **Circle No. A10.**



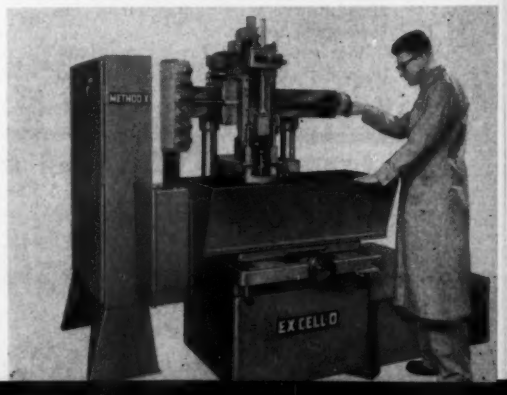
GRINDING FIXTURE . . .

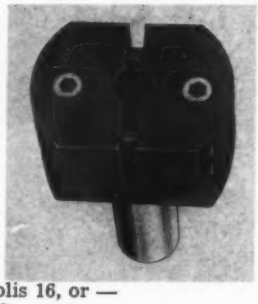
Straight or spiral fluted tools can be ground with correct reproduction using the All-Purpose tool and cutter grinding fixture. It assures fast, accurate index grinding. The capacity is from 0" to 1½". S & D Engineering Co., 2051 W. Mountain St., Glendale 1, Calif., or — **Circle No. A11.**



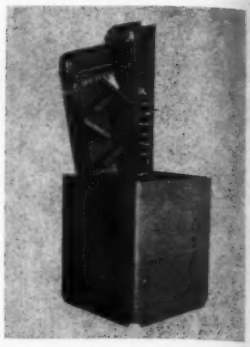
METHOD X MACHINE . .

Style 243-6 vertical Electrospark machine will pierce, drill, trepan, tap or sink a cavity in any material that is an electrical conductor. It is used mainly for machining hard metals or forming special shapes that are difficult to produce Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, or — **Circle No. A12.**

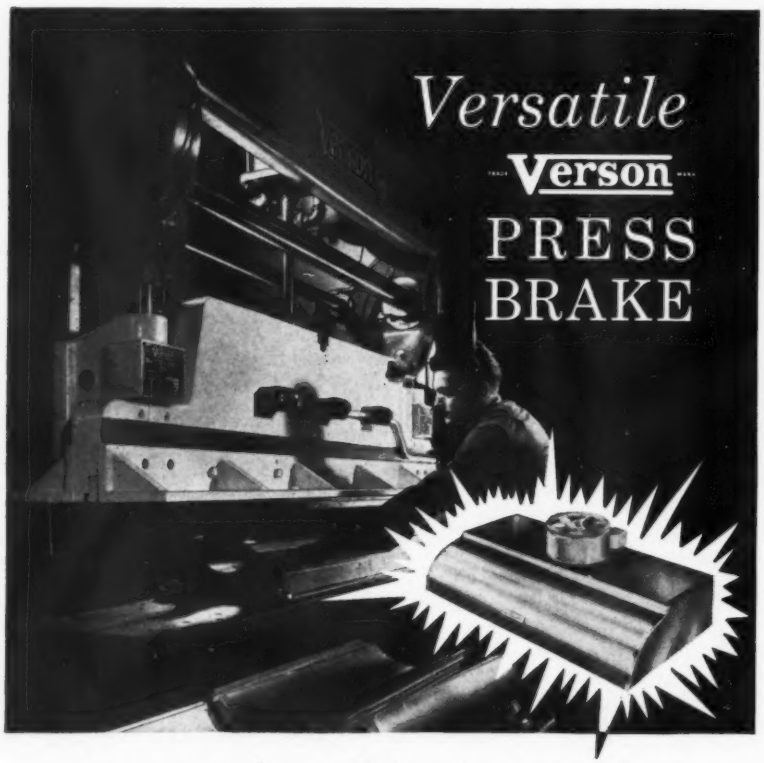




Designed for Use on Multiple Spindle Automatics and Turret Lathes is a 1½" capacity drill and reamer holder. It is available in 1¼", 1½" and 1¾" shank sizes. The jaws move in a vertical direction to accommodate tools from 7/16" to 1½" in capacity. The holder eliminates the need for accessories such as bushings and collets. RoyEL Tools, 4221 Excelsior Blvd., Minneapolis 16, or —
Circle Inform-A-Gram No. A13.



Automatically Feed Sliding, Rolling or Headed Parts into production machines at predetermined speeds with Model 2000 elevating hopper. This unit requires minimum tooling changes to accommodate differently shaped parts. The rate of feed is controlled by a variable speed conveyor. Production Feeder Corp., 3130 Johnnycake Ridge Rd., Mentor, O., or —
Circle No. A14.



. . . can perform all forming operations for Nu-Tone Hood Fan

There is a Verson Press Brake to meet every requirement. Here a Verson Intermediate Press Brake, Model 206-F, equipped with bed and ram flanges, forms the curved front for a Nu-Tone Hood Fan. *All* forming operations for Nu-Tone Hood Fans can be performed on this type press brake.

Versatile Verson Press Brakes are designed and built for long life and superior performance. Their allsteel welded frame assures easily maintained alignment of bed, ram and housing. Long square type gibs are adjustable and spring loaded shoe type brakes provide complete control for the operator.

Investigate Verson Press Brakes. They can produce more of better products at lower cost. Write today for Catalog B-55.

A Verson Press for every job from 60 tons up.

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION
Verson
VERSON ALLSTEEL PRESS CO.
9335 S. Kenwood Avenue, Chicago 19, Illinois
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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES
CIRCLE INFORM-A-GRAM KEY NO. 214

Cut Full Length ¾" Plate Continuously with a ½" hydraulic shear. This is possible because the rake angle of the shear is adjustable. For

precision cutting, knife clearance can be adjusted in 30 sec to match plate thickness. The shear cuts noiselessly without shock, resulting in 2 to 3 times longer knife life. Pacific Industrial Mfg. Co., 848 - 49th Ave., Oakland 1, Calif., —
Circle Inform-A-Gram No. A15.

Quality Control and Inspection Work is handled by precision dial indicators from H. E. Morse Co., Holland, Mich. The Hemco-Reli-A-Check line consists of five types of dial indicator gages and tooling balls. The gages are used for checking "O" ring grooves, depth and groove location, snap ring grooves, and for bores. In addition, there are adjustable dial snap gages. Besides the standard models of each type, the company makes special designs for unusual needs.
Circle Inform-A-Gram No. A16.

A Complete Line of Headed Pins is being manufactured by Durant Tool Supply Co., 1-15 Thurbers Ave., Providence 5, R. I. The pins are available in a range of sizes from 0.020 through 0.1875 by 0.001 increments. They are used by tool and die makers in all types of metal stamping tools, as well as by plastic mold manufacturers. All pins are packaged in boxes of 100 each.
Circle Inform-A-Gram No. A17.

UNWIELDY PARTS HELD TIGHT

At North American Aviation, Inc.

The picture above shows two sizes of dependable Knu-Vise clamps as they are used on a setup designed by North American's tooling specialists. Operation is the assembly of a bulky, hard-to-handle fuselage section of a F-100 Super Sabre.

With speeds faster than sound becoming more and more common, quality control measures and exacting tolerances in aircraft production are vital. That's why positive—fast to grip—quick to release Knu-Vise clamps are so important. Many fixtures are designed for air or oil operated clamps; others, like North American's, for manual operation. Lapeer furnishes a complete line numbering more than 150 models of clamps and pliers. Better investigate this versatility—today. Just write,

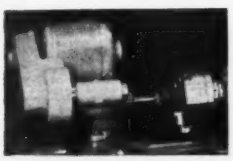
Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

3064 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 2151

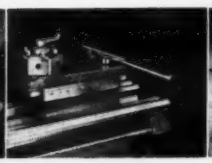


Internal Grinder

SOUTH BEND Lathe Attachments

- *Increase Lathe Versatility*
- *Simplify Difficult Jobs*

Turret Tool Block

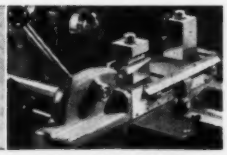


Handlever Bed Turret

Milling Attachment

Dial Indicator Carriage Stop

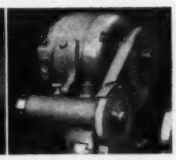
Step Chuck



Handlever Cross Slide

10-in-1 Tool Holder

Handlever Collet



External Grinder

WRITE FOR CATALOG 5700 **SOUTH BEND LATHE**

Building Better Tools Since 1906 • SOUTH BEND, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 2152

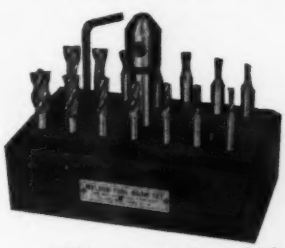
YESTERDAY'S PIONEER • • • TODAY'S LEADER

Just what you need for your TOOL ROOM!

These handy sets fill an important need in every tool room. The convenient block protects tools against damage or mislaying and keeps them together with each size in place, always available for instant use.

WELDON CORNER ROUNDING END MILL SET

This set consists of block with 8 end mills in following radius sizes: 1/16", 3/32", 1/8", 5/32", 3/16", 1/4", 5/16", 3/8".



WELDON TOOL ROOM END MILL SET

This set consists of block with 14 small end mills, in sizes from 1/8" to 1/2". Also one Weldon Holder No. H1-2 with No. 7 B & S Shank.

WELDON "TU-LIP" COUNTERBORE SET

Here you have your choice of 3 sets, made up of stock sizes from 1/4" to 3/4". *Set No. 1, Straight Shanks—Short Type; Set No. 2, Straight Shanks—Long Type; Set No. 3, Morse Taper Shanks.*

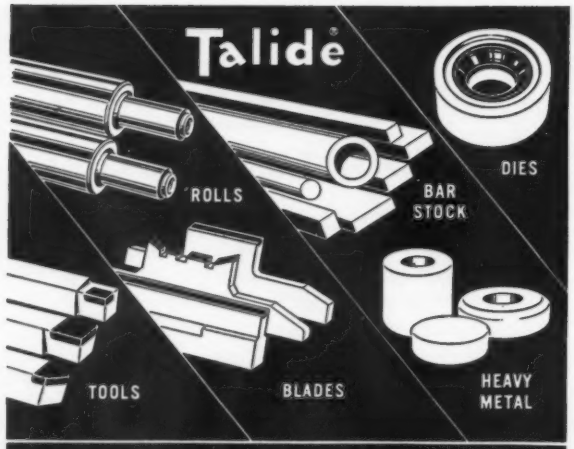
★ **Write for descriptive folder and prices**

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD • • • CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2153



HARDEST MAN-MADE METAL!

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 2161

Commander SELECT-A-SPINDLE

DRILLS . . REAMS . . TAPS
ON 1 DRILL PRESS SPINDLE

- Increases production
- Improves accuracy
- Reduces costs
- Can be used on any drill press

Compactly built—operator has complete visibility of work

Save time...reduce handling . . . improve accuracy—drill, ream and tap on 1 drill press spindle with a Commander SELECT-A-SPINDLE, Dual Speed Turret Head. Speed selection on each spindle permits drilling, counterboring and tapping at recommended speed. Taps on 1, 2 or all 3 spindles using any tap size within capacity. Quick, positive indexing of head without stopping motor . . . selected tool rotates only after spindle is indexed and automatically locked. Ruggedly built for high production work.

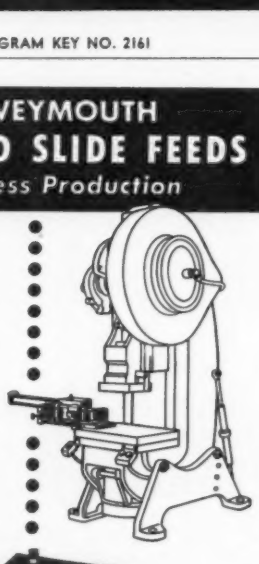
Write FOR CATALOG and the name of your nearby Commander Distributor

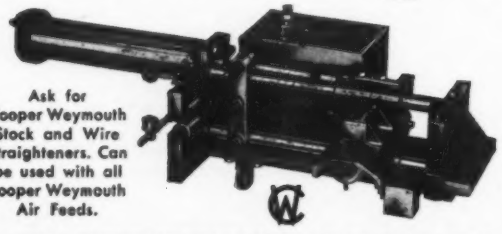
Commander MFG. CO.
4228 W. KINZIE ST • CHICAGO 24, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 2163

COOPER WEYMOUTH
AIR OPERATED SLIDE FEEDS
Boost Power Press Production

Specifically designed to solve the automatic feeding problems in press rooms. Simplified, open throat construction. Air operated from standard shop lines. Easily set up and adjusted at the front, rear or sides of press for accurate long or short runs. Cooper Weymouth Air Feeds, made in five sizes, will feed lengths up to 36", of stock up to 18" in width. They are readily adaptable to material of irregular cross section and ideal for use with hydraulic presses.





Ask for Cooper Weymouth Stock and Wire Straighteners. Can be used with all Cooper Weymouth Air Feeds.

SEND FOR INFORMATION ON THESE AND OTHER PRODUCTS

COOPER WEYMOUTH, INC.
600 HONEYSPOT ROAD, STRATFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 2162

BRYANT TRUE GRANITE
ROCK OF AGES
SURFACE PLATES

Unequalled Wear Resistance!

All Bryant Surface Plates are manufactured from fine-grained *true quartz* granite. Their resistance to wear surpasses *all* other materials used as surface plates.

Patented "head of the grain" finishing process gives added assurance of retained accuracy through years of use.

Full range of sizes available from the same selected black-and-white true granite, in precision, standard and layout accuracies.

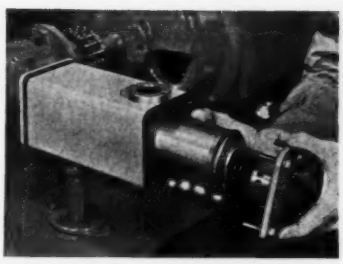
Convenient stands feature both utility and appearance.

Write for quotation, stating size and accuracy desired

BRYANT GAGE & SPINDLE DIVISION
Box 620-H, Springfield, Vermont

Granite Surface Plates • Groove Gages • Internal & External Thread Gages
Magnetic Drum Memory Devices for Computing Systems
DIVISION OF BRYANT CHUCKING GRINDER COMPANY

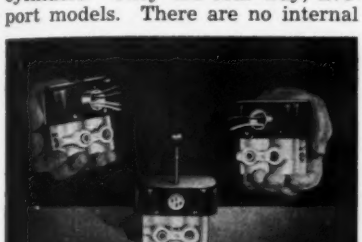
CIRCLE INFORM-A-GRAM KEY NO. 2164



A Signal Notifies the Clogged Condition of this new hydraulic strainer unit. The Telltale strainer is located outside the reservoir, where it can be serviced easily. The Rosaen Co., 1776 E. 9 Mile Rd., Hazel Park, Mich., or —
Circle Inform-A-Gram No. A18.

Turn Any Sheet Metal Locking Edge in Seconds with an air-powered Pittsburgh lock hammer. It easily handles 30- to 24-ga. sheet metal, doing the job in one pass — faster, cleaner, smoother and without dents. This portable hammer is also available for heavier gauges. Modern Mfg. Co., Willow Grove, Pa., or —
Circle No. A22.

Three New Quick-Dump Control Valves have been developed for fast, smooth operation of double-action cylinders. They are four-way, five-port models. There are no internal



springs, packings, pistons or sliding metal-to-metal contacts. Two of the valves are electrically operated and the third is equipped with a hand lever. Humphrey Products Div'n, General Gas Light Co., 202 N. Park St., Kalamazoo, Mich., or —
Circle Inform-A-Gram No. A19.

Heavy Duty Service is provided by the air cylinders designed by Densmore Engineering Co., Inc., 235 E. Greenleaf St., Compton, Calif. The capsule type gland has a long rod guide and independently adjustable "V" rod packing. Operating pressures are 150 psi on air and 500 psi in hydraulic service. The cylinders are available in strokes up to 18', from 3" through 8" bore, with a wide choice of piston rod sizes.
Circle Inform-A-Gram No. A20.

High Speed End Mills Up To ½" Dia are included in the line produced by Fastcut Tool Co., 7405 E. Davison, Detroit 12. N-Mills are now available in 26 types, covering single end

and double end, in two, three and four flute; and a two flute slotting or router bit. These end mills are reported to be faster cutting, extremely accurate and longer lasting.
Circle Inform-A-Gram No. A21.

Foster Automatic Control
Reduces Scrap & Improves Quality

mounts on any grinder to solve your external cylindrical grinding production problems

Foster Electrosizer assumes complete control of the actual grinding cycle and eliminates the human element of error in production grinding. Close tolerances are held consistently. Wheel life is increased by consistent grinding speed.

It's compact and readily installed on most any hydraulically or electrically operated machine and is so simple in concept that set up and size change is a matter of seconds.

Can be readily adapted for full automation.

1
Operator engages caliper, cocks gage, and advances the wheelslide.

2
Machine grinds at fast feed until within a few thousandths of exact size.

3
The gage signals the machine to reduce grinding speed and go into extremely fine feed. This improves finish and corrects any out-of-round condition.

4
When size is reached, gage signals the wheelslide to retract.

ALSO
Foster Visual Control and Snap Gages

Write for full information

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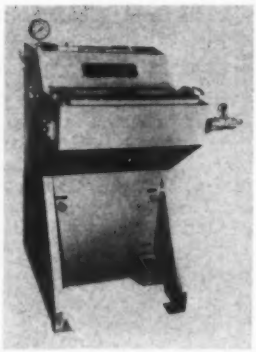
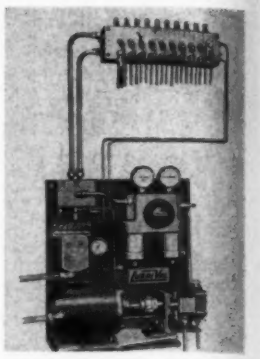
ENGINEERING CORPORATION
4200 N. Woodward
Royal Oak, Mich.

A New Versatile Wet Blast Unit has been announced by The Cro-Plate Co., Inc., 747 Windsor St., Hartford, Conn. It is adaptable to the deburring of small machined components. Guns within the cabinet can be fixed in position, rotated or stroked if necessary. The photo shows the unit with an air cylinder used for a lateral stroking motion. **Circle No. A23.**



This New Type of Circulating Oil System serves the lubrication needs of presses, automatic and semi-automatic machine tools, etc. The Lubrival system monitors its own operation through a pressure sensing mechanism to warn of clogged or broken lines in any part of the system. Details on the system are found in Bulletin 70 made available by The Farval Corp., 3249 E. 80th St., Cleveland, or—**Circle No. A24.**



Zagar Tools

HOLD YOUR WORK—AND YOUR BUSINESS!

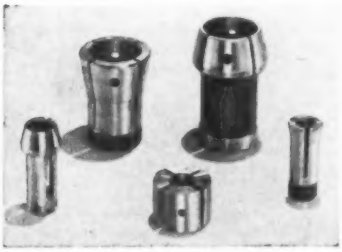
Collet indexing fixture

Collet holding fixture

Vertical-horizontal collet fixture

ZAGAR HOLDING and INDEXING FIXTURES

Zagar fixtures offer you a most inexpensive way to machine small parts. Set-up is speeded and much special tooling eliminated. Slot milling, straddle milling, drilling, tapping and grinding of small pieces can be done most profitably with Zagar fixtures, *available from stock.*



COLLETS, PADS, BLANKS

Five types: No. 310 Zagar Master; Nos. 2 and 6 W. & S.; No. 5-C; No. 6 W. & S. pads. All but Zagar No. 310 are standard machine tool sizes. All collets are made of oil-hardened tool steel; have flat tops for locating purposes.

★ ★ ★

Ask for Zagar Catalog "T-5"

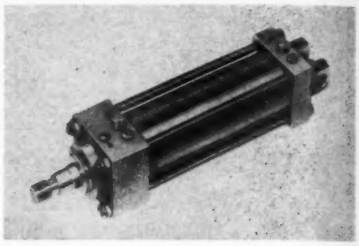
ZAGAR, INCORPORATED

23894 LAKELAND BLVD. • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

CIRCLE INFORM-A-GRAM KEY NO. 218

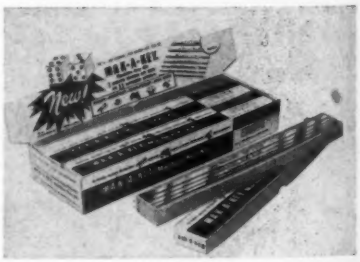
Rated at 250 Psi for Pneumatic Use or up to 1000 psi for hydraulic use are the Squarehead S Line fluid cylinders. They come in seven bore



sizes up to 6". The rod end of these cylinders features a quick change rod cartridge. For copies of an eight-page catalog with complete details on the cylinders, contact Teer-Wickwire & Co., 1936 Wildwood Ave., Jackson, Mich., or — **Circle Inform-A-Gram No. A25.**

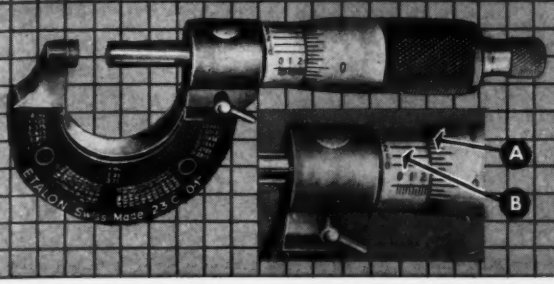
Simplify Handling of Dies and Similar Loads with a manually-operated hydraulic lift. Available in 500-lb or 1,000-lb capacities, the E-Z lift has a die-handling table that is fitted with six easy-turning full-width rollers. Its lifting range is 7" to 57" above the floor. Crown Controls Co., Inc., New Bremen, O., or — **Circle Inform-A-Gram No. A26.**

Machine Key Stock Bar Kits provide a convenient assortment of key stock for repair and maintenance departments, toolrooms and shops. The 7-11 Mak-A-Key Kit contains seven



machine key bars of different sizes which can be filed to fit 11 different keyways. DeVan-Johnson Co., 500 Rathbone Ave., Aurora, Ill., or — **Circle Inform-A-Gram No. A27.**

ONE PIECE STAINLESS STEEL SPINDLE AND SCREW
Hardened and ground from the solid . . .



ETALON 23C MICROMETER

A—Half-thousandth graduations on thimble allow tenths readings with only 5 Vernier graduations.

B—Deep machine divided graduations on both thimble and barrel assure easy reading.

• Reads to .0001" • Forged frame • Heavy duty tungsten carbide measuring faces, optically lapped • Quick acting positive lock • Feather touch friction stop assures senstive feel • Dull chrome finish on thimble and barrel eliminates glare • Built for accuracy under the most rugged applications • In handsome contour case.

WRITE FOR CATALOG on complete line of precision measure instruments:
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CIRCLE INFORM-A-GRAM KEY NO. 2191

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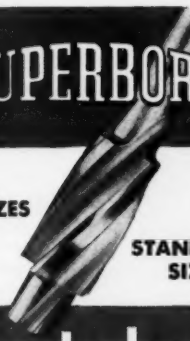
The next time you require parts of any shape or size up to 10"x 14"x ¼" thick of any stampable material send your print, sketch or part for an . . .

*Analyzed Quotation

Federal **TOOL & MFG. CO.**
Quality Stampings in Small Quantities
3641 Alabama Ave., Minneapolis 16, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2192

SUPERBORE



3 SIZES
STANDARD SIZE

Counterbores

1/64" OVERSIZE

Available from stock for each screw size

1/32" OVERSIZE

NEW!

30° Right Hand Spiral, 4 Flute

Now you can speed up production 100% with our *New* 30° fast right hand spiral, four-flute counterbores.

You will find that faster feeds are possible with this freer-cutting tool.

Hardened counterbore blanks in stock can be ground to any special pilot and flute diameters in one week.

Few territories open for manufacturer's representatives.

FREE!

Complete Reamer catalogue with world's Greatest Reamer selection by the Thousands' and thousandths. Write for it today!

TWENTIETH CENTURY MANUFACTURING CO.
ROUTE 176 and BRADLEY ROAD
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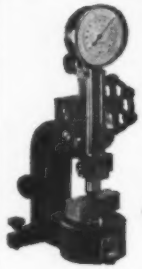

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has been done with the **SCLEROSCOPE**
Since 1907

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THE SHORE INSTRUMENT & MFG. CO., Inc.
90-35 Van Wyck Expressway
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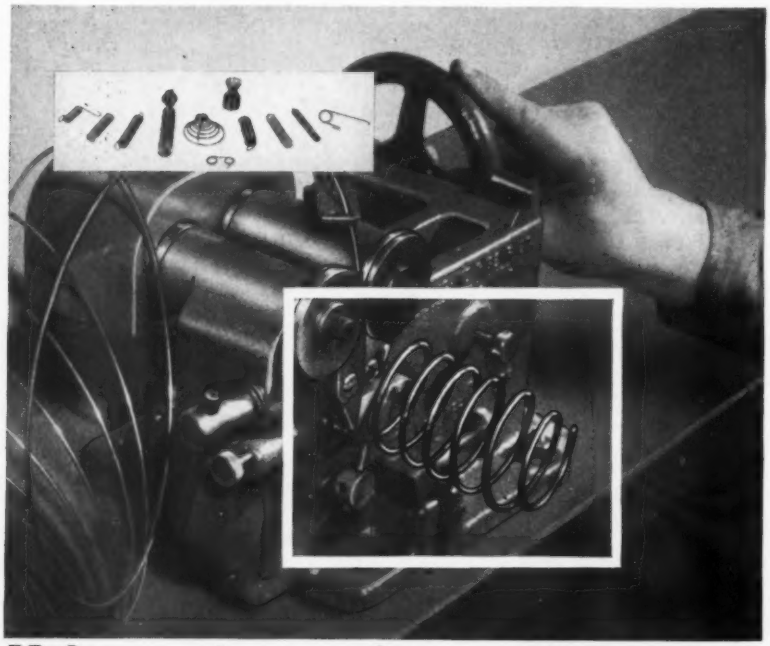
CIRCLE INFORM-A-GRAM KEY NO. 2201

JIG BORING
and
Large Precision Machining
Done to your specifications
We Have
21 Jig Borers
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2202



Make any type spring . . . fast, exact!
WITHOUT USE OF ARBORS

For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005″ to .125″, you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32″ to 12″ and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!

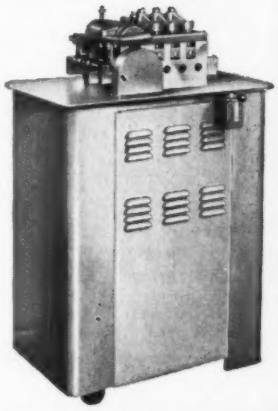
PERKINS
MACHINE AND GEAR CO.
Special Machinery Division,
West Springfield, Mass.

Starret adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.

Perkins Machine and Gear Co.
Special Machinery Division, Dept. B1
W. Springfield, Mass.
Please send information and prices on Perkins Spring Coiler.
Hand Model ☐ Power Model ☐
Name.....Title.....
Company.....
Address.....
City.....State.....

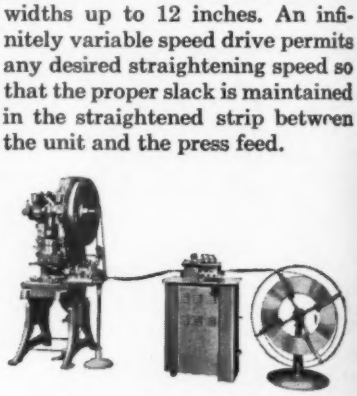
CIRCLE INFORM-A-GRAM KEY NO. 2203

FLEXIBILITY
in Stock Straightening



WITTEK
STOCK STRAIGHTENERS

Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



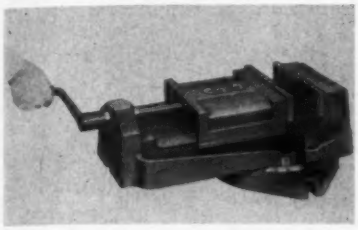
This typical Wittek automatic production feeding setup includes—Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

Write for full particulars
WITTEK Manufacturing Co.
Production Feeding Equipment
4323 W. 24th Place • Chicago 23, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 2204

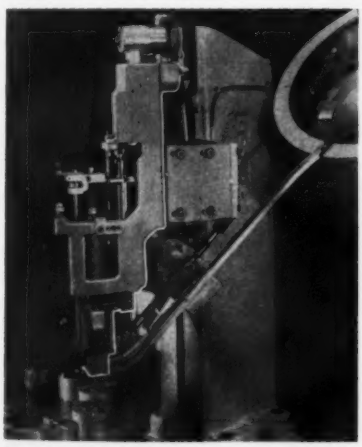
Increase Abrasive Belt Life As Much As 40% with a new rubber contact wheel made with slashed serration. The "X" wheel is used for backstand grinding and polishing operations. An improved type of flange construction eliminates the possibility of mis-seating the flange because it is an integral part of the wheel. Minnesota Mining and Mfg. Co., Dept. F7-54, 900 Fauquier St., St. Paul 6, or —
Circle No. A28.

A Heavy-Duty Model has been added to the line of Low-Boy machine vises manufactured by Universal Vise & Tool Co., Parma, Mich. Model P-3 has an 8½" jaw width with 6¾" maximum jaw opening,



with steel jaw plates in place. It is equipped with coolant run-off trough, bronze nut for the main screw and large size main screw for maximum holding power.
Circle Inform-A-Gram No. A29.

Automatically Guide Parts 1/16" to 3" with a standardized parts positioner. Model PR-3 is capable of guiding a wide variety of parts from feeder track to fixture at rates up to 7200/hr. The positioner is available



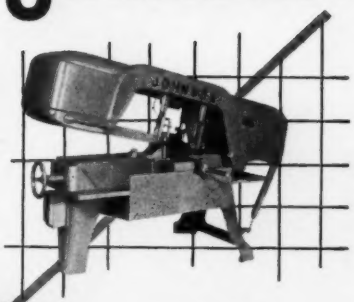
in strokes of 1", 2", 3" or 4" with variable speed up to ½ sec/cycle. Model PR-3 serves as an efficient sensing device. If a part is missing or improperly placed, it stops automatically with the ram in forward position. Dixon Automatic Tool, Inc., Rockford, Ill., or —
Circle Inform-A-Gram No. A30.

A New Vertical Milling Machine has been designed by Rotex Punch Co., Inc., 2350 Alvarado St., San Leandro, Calif. Model VM features an all angle vertical head, a 0.0005" tolerance/ft, a 5" x 20" table working surface and longitudinal feed of 12". There are five spindle speeds from 390 to 5200 rpm which interchange easily. The machine will do many jobs efficiently and economically.
Circle No. A31.

Time Study your Metal Cutting... and You'll Get a Johnson

MODEL J

Increase your output with a big, rugged Johnson Model J (Heavy Duty) Saw. Cuts anything in your stockpile . . . 10" rounds, 18" flats, heavy structurals and odd shaped pieces. Variable speed. Optional cooling attachment permits continuous cutting on production jobs.



MODEL B

Stop losing man hours on slow, inefficient metal cutting machines. Specify a Johnson Model B (wet or dry) Saw for top production. Variable speed. Saws 5" rounds, 10" flats, odd and irregular shapes too. Can be caster equipped for portability.

MODEL M

End slow, inefficient hand cutting in your plant. Just wheel the Johnson Model M "Mobile" up to the job. Saw anywhere. Cuts 5" rounds, 10" flats, structural steel, pipes, conduits, angle iron, etc. Carries its own extra blade supply.

Johnson
MANUFACTURING CORPORATION
1015 Barnes Street
Albion, Michigan

• • • • ***WRITE TODAY*** for Your copy of the big, illustrated Johnson Saw catalog. It's yours for the asking!

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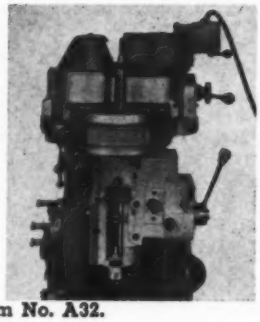
CIRCLE INFORM-A-GRAM KEY NO. 221

Milling, Drilling and Boring Operations at any angle are performed by Model 120 mill head. All automatic feed controls are front positioned for fast operation. The mill head has infinite speed from 100 to 3600 rpm and infinite feed of 0.0" to 0.012". Rate of feed can be selected with machine running, standing still or under load. Rusnok Tool Works, 4840 W. North Ave., Chicago 39, or — **Circle Inform-A-Gram No. A32.**



A Comparator Air Gage that works on a back-pressure circuit principle has been introduced by Freeland Gauge Co., 9940 Freeland Ave., Detroit 27. With Model L, a workpiece can be inspected for roundness, taper, bell-mouth, and size measurement. It assures easy maintenance and constant accuracy. Model L air gage has adjustable limit pointers and linear calibrated scales. **Circle No. A33.**

GREIST MICRO-HEIGHT® "4"

increased range gives new model 5" direct capacity

Micro-Height "2" ...3" direct capacity. Without scriber, only $36.50. Risers extend capacity to 9".

Micro-Height Gage speeds layout and inspection. Scribes like a vernier gage...holds dial indicator for quick, accurate inspections.

Reads faster than a micrometer. Hundredths on big barrel...thousandths on large head that cuts reading time, reduces errors, increases accuracy.

New Micro-Height "4". With scriber inverted, reads directly from zero at base to 5". Accuracy ± .0003". Price, without scriber, only $57. Adding lapped riser extends capacity to 11".

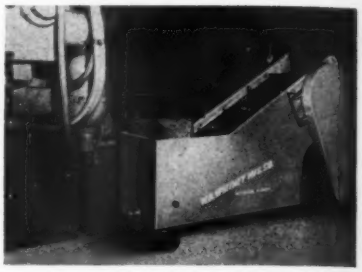
Ruggedly built for dependable accuracy. Protected by rustproof, satin-chrome finish. Micro-Height quickly pays for itself. Saves money whenever you measure, layout, inspect. Can you afford to be without one?

Call your ***GREIST*** *distributor or write*
THE **GREIST** MANUFACTURING COMPANY
485 Blake Street, New Haven 15, Conn.

Precision Products since 1871

CIRCLE INFORM-A-GRAM KEY NO. 222

Automatic Handling of Work is performed by portable Model 108 conveyor. This conveyor is designed for centerless grinders but is adaptable to many other applications involving dipping to prevent rust, and to increase handling efficiency or minimize manual handling of parts. Belt speed is 400 ipm. W. A. Whitney Mfg. Co., 632 Race St., Rockford, Ill., or — **Circle No. A34.**

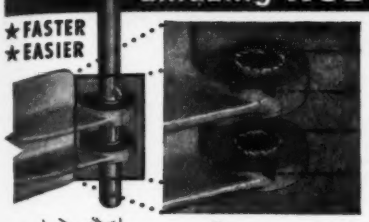


An Outside Bridle Type Clutch Key Spring Arrangement has been designed and installed on No. 00 two-ton Press-Rite press produced by Sales Service Machine Tool Co., 2363 University Ave., St. Paul 14, Minn.

This key spring eliminates the need for old type clutch springs and increases tension, allowing for faster engagement. A special high strength frame reduces die-wearing deflection and gives longer die life.
Circle Inform-A-Gram No. A35.

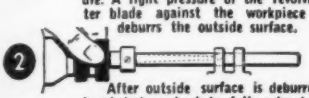
HOW TO....
DEBURR THESE INACCESSIBLE HOLE FACES BY MACHINE OPERATION with the amazing NOBUR TOOL

★FASTER
★EASIER

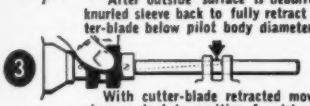


No more hand finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by machine operation. Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.

1 Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter blade against the workpiece quickly deburrs the outside surface.



2 After outside surface is deburred, slide knurled sleeve back to fully retract the cutter-blade below pilot body diameter.



3 With cutter-blade retracted move workpiece or tool to position for deburring inside surface. Raise cutter-blade to deburr first one surface then the other.

Write for FREE Folder
Send for all details on Nobur Tool Products TODAY!

M-11

NO/BUR TOOLS NOBUR MANUFACTURING CO.
6860 Farmdale Ave., No. Hollywood, California

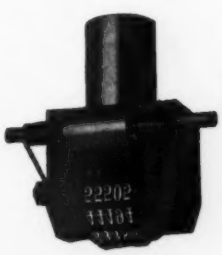
CIRCLE INFORM-A-GRAM KEY NO. 2231

NUMBERALL
CUTS THE COST OF STAMPING NUMBERS

NEW MODEL 70
MULTI-WHEEL NUMBERING MACHINE

The most efficient method of stamping numbers into metal. Repeats the same numbers until changed. Model 70 NUMBERALL machines are used in all industries to mark various parts. Stamps numbers, etc., quickly . . . neatly. Perfectly aligned. Much better marks are produced by these machines than by single stamps or steel type, and at a far lower cost. Shank for Hand or Press and with any number of wheels from 3 to 20. Can be furnished in 1/32" to 3/8" high figures, sharp face gothic or shaded roman style. Write for Bulletn TP-70.

Hand shank Model 70 illustrated. Press shank for foot or power presses also available.



Model 50 Automatic Numbering Head (at left). Write for Bulletin TP-70.

We also make other numbering heads, non-automatic, with quick-set wheels. Write for catalogs TP-80 and TP-85.

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2233

Drill Hardened Steels without Annealing—

USE The New IMPROVED "HARDSTEEL" DRILL

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

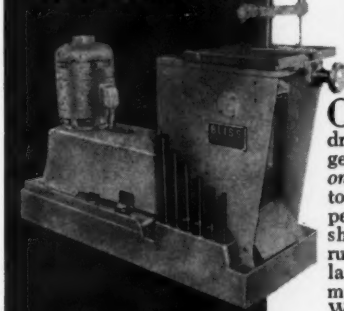
Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.
1368 East 222nd St. • Cleveland 17, Ohio
"HARDSTEEL"

CIRCLE INFORM-A-GRAM KEY NO. 2232

new— low cost



HYDRAULIC KEYSEATER

• fast set-up — saves time and money
• low cost operation — uses standard tool bits
• heavy-duty hydraulic circuit—assures accurate keyways
• compact, 21" x 61"—no special foundation
• versatile—cuts standard, tapered keyways; internal splines

ONLY WITH BLISS' new Hydraulic Keyseater can you get such a size range *from one machine*—¼" to 2" wide, to 12½" long, standard or tapered. It's easily set up for short or long production runs in small, medium or large plants, warehouses, maintenance departments. What's more, no foundation is needed. Speeds range up to 35 spm; heavy-duty hydraulic system is to JIC specs. All adjustments are readily accessible. Seven cutter bars, with standard tool bits, are also available. Special attachments permit internal spline cutting.

Get all the cost-cutting, time-saving facts by writing today for Bulletin 34—

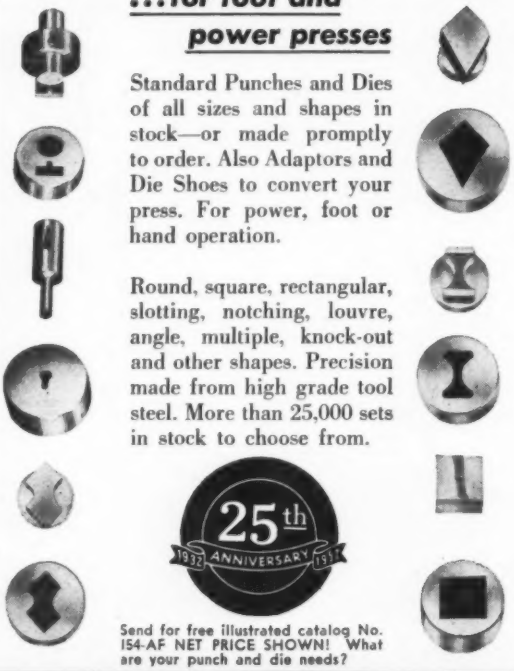
BLISS
SINCE 1857

E. W. BLISS COMPANY
1132 North Seventh Street
San Jose, California

CIRCLE INFORM-A-GRAM KEY NO. 2234

Punches and Dies

...for foot and power presses



Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.

Round, square, rectangular, slotting, notching, louvre, angle, multiple, knock-out and other shapes. Precision made from high grade tool steel. More than 25,000 sets in stock to choose from.

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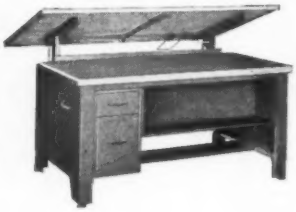
WARD Machinery Co. 564 West Washington **Chicago 6**

CIRCLE INFORM-A-GRAM KEY NO. 2241

MAYLINE



The MAY-O-MATIC Drafting Table

A table the draftsman will enjoy. A touch of a lever enables him to adjust for table height and top slope. He can reach easily any part of his drawing; and he can change his working position at his convenience.

Send today for literature describing the May-O-Matic table. Ask also for the 4-Post steel base table.

Mayline Co., Inc.
635 No. Commerce St.
Sheboygan, Wisconsin

Steel 4-Post Table

MAYLINE

MAYLINE MAYLINE

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NEW

WEIGHS JUST 2 LBS. HAS 1 4" CAPACITY

INDUSTRIAL AIR DRILL HAS METERING TRIGGER

Gives positive R.P.M. Control from 0 to 2500

New SP-1000 Industrial Air Drill has Superior's exclusive metering trigger — gives positive R. P. M. control from 0 to 2500. The SP-1000 weighs only 2 lbs., has ¼" capacity, a safety chuck shield and ¼ h.p. at 90 P.S.I.

Light weight and easy to use, the drill cuts down operator fatigue — is an excellent production tool for automotive, aircraft, sheet metal and other industrial operations. Nickel steel gears and pre-loaded sealed bearings keep maintenance costs at a minimum. Available with pistol grip, as illustrated, or straight handle.

Write Dept. P-5

SUPERIOR PNEUMATIC & MANUFACTURING, INC.
4758 Warner Rd. Cleveland 25, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2243

HAND KNOBS

6 SIZES
CAST IRON

Tapped, Reamed or Blank.
Hex-shaped hub for extra tightening.

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TIETZMANN TOOL CORPORATION
Dept. HK-2 • Englewood, Ohio

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NOW GET CLEAN SURFACED PARTS FROM YOUR AUTOMATICS ... *UNMARRED* BY TOOL WITHDRAWAL MARKS

THE NEW **RELIEVOMATIC**
SELF-RELIEVING TOOL HOLDER

SAVES YOU COSTLY SECONDARY FINISHING OPERATIONS

Avoid scratches like this

All clear with "Relievomatic!"

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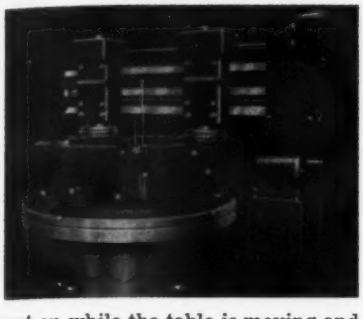
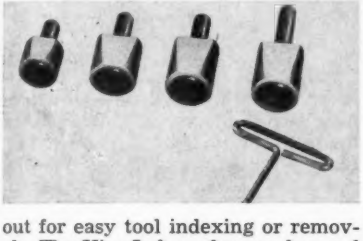
CIRCLE INFORM-A-GRAM KEY NO. 2245

Extremely Accurate Milling is possible using a continuous rotary milling machine. The work is fed continuously in multiple setups to the milling cutters. Finished work can be taken off the table and new work



put on while the table is moving and the cutters operating. The spindle heads are independently adjustable vertically and horizontally. Machine Tool Dept., Box 161, Hamilton Div'n, Baldwin-Lima-Hamilton Corp., Hamilton, O., or —
Circle Inform-A-Gram No. A36.

Eliminate Damage to Tools or Fixtures due to hammering or pounding the wedges with the Vise-Lok wedge. This positive locking wedge can be tightened or released with an Allen type wrench. It turns in for wedging and positive locking and turns

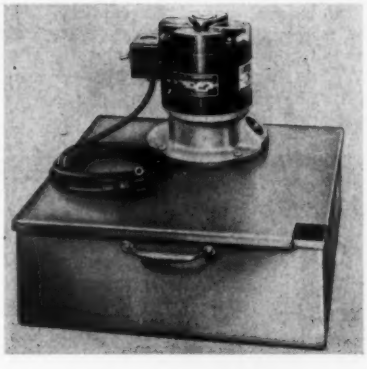


out for easy tool indexing or removal. The Vise-Lok wedge can be used in tool holders, milling cutters, lathe tools, clamping devices, and jigs and fixtures. Futurmill, Inc., 6360 Highland Rd., Pontiac, Mich., or —
Circle Inform-A-Gram No. A37.

Deep Reach Clamping Operations are facilitated with No. 48 Superclamp. Forged steel heat-treated frame and large diameter full length

screw with forged wing insure strength and durability. All sizes are individually power-tested. The No. 48 clamp is made in four stock sizes. The Cincinnati Tool Co., Cincinnati 12, O., or —
Circle Inform-A-Gram No. A38.

Supply Coolant from minimum to 3000 gal/hr with a self-contained pump and tank unit that is suited for permanent or portable use. Model 7500A-T is mounted on a steel tank with built-in baffle that eliminates chips from the coolant system. It is the largest of the Brady line of package coolant supply units and is adequate to supply small, medium and large machine tools. Brady Pump Corp., 1001 E. 18th St., Muncie, Ind., or—**Circle Inform-A-Gram No. A39.**



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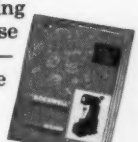
A staff of WILSON hardness testing experts is available to help choose the model best suited to your job—and provide quick emergency service if it is ever needed.



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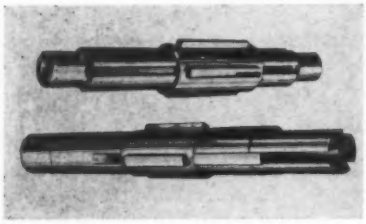
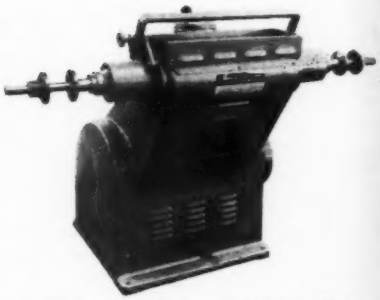
CIRCLE INFORM-A-GRAM KEY NO. 225

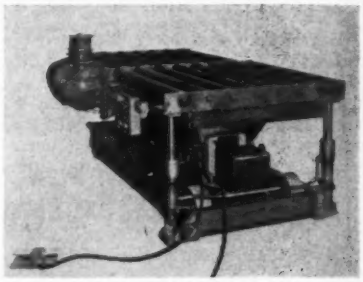
A New Line of Expanding Jaw Mandrels has been designed for use as internal chucks for gripping and driving bored parts during machining. Erickson-Nicholson Type expanding jaw mandrels are guaranteed concentric within 0.0015" TIR. They are used on lathes, milling machines, grinders, shapers, planers or other types of machine tools where work can be held between centers. Type A step-jaw design and Type B straight-jaw design are produced. Erickson Tool Co., E. 23rd and Hamilton Ave., Cleveland 14, or —
Circle Inform-A-Gram No. A40.



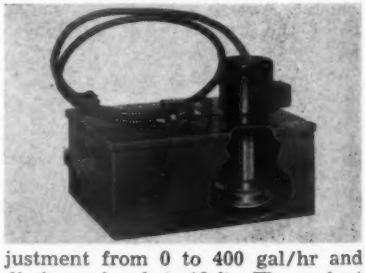
A Special Braking Bar is featured on this variable speed polishing and buffing lathe produced by Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich. The operator on either side of the lathe can actuate the brake. Model VRO is suited to polishing, brushing or buffing operations. The spindle speed is infinitely variable between 1500 and 3000 rpm. The lathe is reported to increase production and produce better finishes.
Circle Inform-A-Gram No. A41.



Handle Extra Heavy Dies with a winch-equipped roller top lift platform. The unit consists of a hydraulic lift table built to 20,000 lbs lifting capacity, with two sets of conveyor rollers welded to the top. A special motor driven winch is mounted in the center. Loading or unloading of the die is done by attaching the winch hook and pressing a button. West Bend Equipment Corp., 350 Water St., West Bend, Wis., or —
Circle Inform-A-Gram No. A42.



The Bantam Coolant Pump System is produced by S. Gelber and Sons, Inc., 5806 N. Lincoln Ave., Chicago 45. It is designed with one moving assembly making it ideal for handling highly abrasive liquids. The flow-control valve gives instant adjustment from 0 to 400 gal/hr and discharge heads to 12 ft. The coolant pump system can be adapted to the needs of drill presses, lathes, tappers, cut-off saws, grinders, belt sanders, milling machines and other small machine tools.
Circle Inform-A-Gram No. A43.



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Cleveland INSTRUMENT COMPANY
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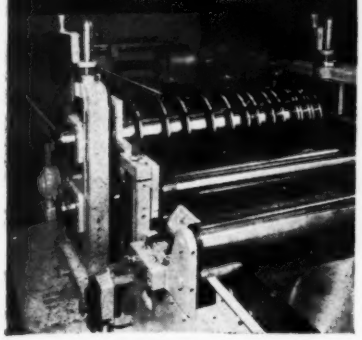
CIRCLE INFORM-A-GRAM KEY NO. 226

YODER SLITTING LINES



PAY BIG DIVIDENDS WORKING ONLY ONE DAY PER WEEK!

In one plant, two Yoder tube mills and about 50 punch presses are being supplied with slit strands by one Yoder Slitting Line operated an average of only *seven hours per week.*

In another plant, a Yoder slitting line, *operated from six to eight hours per week,* is supplying two intermittently operated roll forming machines with total requirements averaging 100,000 feet per week.

These typical examples demonstrate, first, the big potential output of a relatively small, inexpensive Yoder standardized Slitting Line and, secondly, its big profitability. Assume production of only 35 tons of slit strands per 8 hour shift, one day per week, and the total per year would be 1750 tons. Estimating the saving in slitting cost at only one-half cent per lb., the total annual saving would be $17,500.00.

Besides the big convenience of doing your own slitting, such savings will often repay the investment in a few months.

The Yoder Slitter Book **is a comprehensive treatise on slitter operation and economics, with time studies, cost analyses and other useful data. It is yours for the asking.**

THE YODER COMPANY
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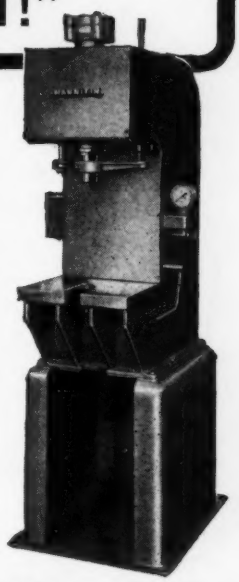
ENGINEERING YODER MANUFACTURING SLITTING LINES

CIRCLE INFORM-A-GRAM KEY NO. 2271

"BEST $1530 WE EVER SPENT!"



That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

Hannifin Corporation, 563 S. Wolf Road, Des Plaines, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 2272

DEKA® BORE

cuts setup time 300% at FORD PLANT!

THE PLACE: FORD MOTOR CO., AIRCRAFT ENGINE DIVISION, CHICAGO
THE JOB: BORING HIGH ALLOY STEEL LINERS IN MAGNESIUM HOUSING (36 Rockwell "C")
REPORT BY: TOOL ENGINEERING DEPT.

"Bore diameter tolerance is plus or minus .0003". There's an edge wear of .0001" to .0002" on the tool bit in the initial pass. Before, each final pass took several time consuming adjustments. We changed to a Deka-Bore boring head, and cut setup time 300%, because the Deka-Dial permits positive .0001" adjustment on all settings, in a few seconds. No backlash, either."

DEKA® BORE

OFFSET BORING HEADS
BORING BARS
REPEAT TO .0001"
IN 30 SECONDS!
100% GUARANTEED!

Attach this ad to your letterhead for free demonstration or literature!

PRECISION TOOL & MFG. CO. OF ILL.

1305 South Laramie, Cicero 50, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 2273

James Morrison, Unisorb manager, points out cost savings to Francis Cusamano, plant engineer, of the Farrington Co. Unisorb cushions the blow of this 125-ton Bliss press as well as all other machinery in this plant.

Save up to 30% on Machinery Installation with UNISORB

You can save three ways by using Unisorb . . .
- Installation costs are cut up to 30%
- 80% saving in time
- No floor drilling, no bolts or lag screws

Plus . . .
Vibration is reduced up to 85%, machines work better, last longer. And, they can be moved anywhere, anytime.
Unisorb is impervious to oil and cleaning solutions. Permanent alignment, no "walking," precision shimming.

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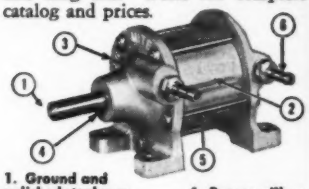
CIRCLE INFORM-A-GRAM KEY NO. 2281

AIR-MITE AIR CYLINDERS

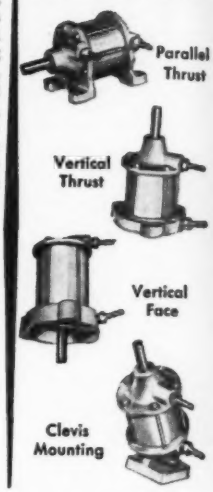
Low Cost . . Compact . . Powerful . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.
4405A W. KINZIE • CHICAGO, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 2283

SCHERR PRECISION MEASURING TOOLS

NON-ROTATING SPINDLE BLADE TYPE MICROMETER HEAD

to be built into fixtures, machine tools, delicate instruments and cross-slides.

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For Measuring of narrow depth grooves, slots, keyways, splines, square threads, recesses and similar hard-to-measure surfaces.

BLADE THICKNESS .030"
GAGING DEPTHS TO ¼"
Available Carbide-tipped
Spindle and Anvil Blades are hardened, ground and lapped to contact fit

Graduated in .001"
Ranges: 0-1", 1-2", 1½-2½", 2½-3½" 3½-4½" and others

Mandrel Type MICROMETER Sets
with TUBULAR Frame for • EXTRA STRENGTH • LIGHT WEIGHT

Each Set has a range of 6" and is equipped with setting Standards & mandrels in finished wooden case
Available from 6" to 96"
Light Weight Frames For Extra Large Sizes

Sold thru Tool Supply Houses **WRITE FOR ILLUSTRATED FOLDER**

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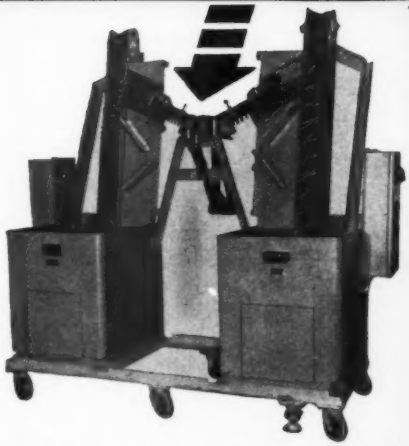
200-T LAFAYETTE ST. • NEW YORK 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2282

DUPLEX FEEDALL UNIT FEEDS 2 *Different Parts*

. . . AT SAME TIME
. . . IN 4 STREAMS



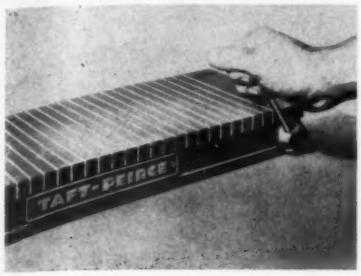
This ingenious arrangement of 2 Model 2200 Feedall Units was necessary to feed two different sizes of headed parts in two streams each to an Avey Automatic Drilling Machine. Notice that the unit is made fully portable by being built on a steel base with heavy casters.

Tell us your automatic feeding problems and let our engineers help you.

FEEDALL INCORPORATED WILLOUGHBY, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2284

100% All-Over Holding Power is a feature of Model 824 permanent magnet chuck. The special Alnico V chuck design eliminates all dead spots and provides full edge-to-edge useable surface. The chuck will handle a wide variety of work, including grinding, light milling and

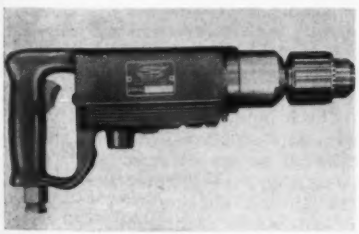


shaping. It can also be ganged for handling extra large pieces. Workpieces can be moved on and off quickly and easily. For details, see a bulletin prepared by The Taft-Peirce Mfg. Co., Woonsocket, R. I., or—**Circle Inform-A-Gram No. A44.**

Obtain Accuracy in Locating Small Drills in jig bores, drill presses, lathes, milling machines, etc., with the Jig Bore Special. The set eliminates the hazard of a broken drill

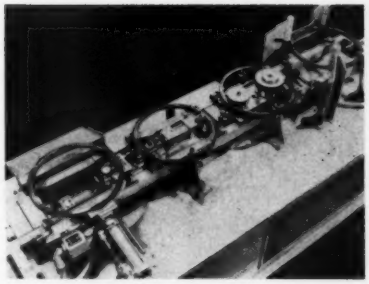
in a jig or fixture. It takes drills from 0.029" to 0.193". The adapters have a ½" shank. Hawkeye Specialty Co., 1532 W. 14th St., Davenport, Ia., or — **Circle No. A45.**

A 1,000 Rpm Heavy Duty Drill with ½" Jacobs chuck has been announced by Air Speed Tool Co., 1502 W. Slauson Ave., Los Angeles 47.



Model H features sub-assembly construction, which makes servicing easy. It weighs 9 lbs and develops 22 lbs-ft of torque.
Circle Inform-A-Gram No. A46.

Fully Automatic Ring Gear Straightening is performed at 400 parts/hr by this machine produced by Cargill Detroit Corp., Birmingham, Mich. The parts are 14" dia fly wheel gears. The machine rounds up the rings from 0.060" out-of-round to under 0.007" TIR. It can process ring diameters ranging from 12" to 16" with a minimum of set-up time and tooling. Gears which fail to meet gaging acceptance after straightening are automatically rejected to the side of the machine.
Circle Inform-A-Gram No. A47.



ARE YOU USING- HOVIS UNIVERSAL Master COMPOUND DIES

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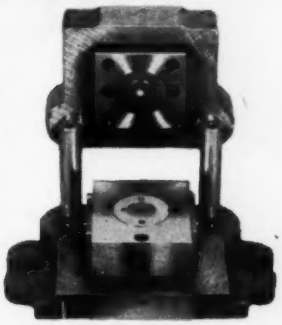
The "MODERN METHOD" adopted by MANUFACTURERS NATIONALLY

NO NEED TO MAKE A NEW DIE FOR EVERY STAMPED PART

● By simply removing and replacing five, small, interchangeable inserts a new part may be produced . . . This method makes possible all production including irregularly shaped pieces and shallow draws.



Made in 5 sizes:
¾" - 1½" - 2½" - 4" - 6"

Specialists in designing and manufacturing MULTI-DIES as well as supplying COMPLETE TOOLING FOR ALL SIZES OF NUT FORMERS

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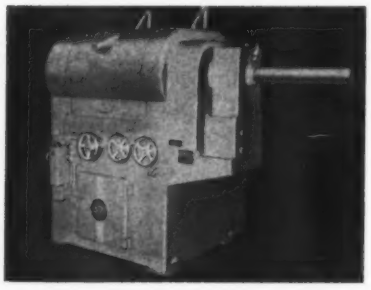
Phone: Slocum 7-4800 Suburb of Detroit

CIRCLE INFORM-A-GRAM KEY NO. 229

Easier, Truer Noise Inspection of Special Large-Size Gears is possible with a modified standard gear speeder from Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12. Model 1129-SP uses enclosed spindles and a special built-in listening horn for better definition of noise characteristics. The speeder can handle gears up to a 23" maximum dia with a 10" maximum face width.
Circle Inform-A-Gram No. A48.

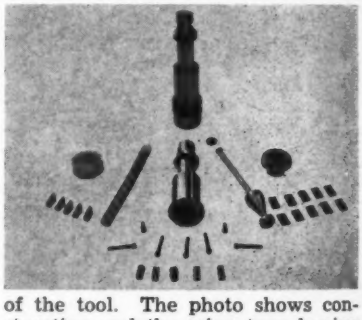


Simplify the Building of Automation-Type Special Machines for drilling and tapping operations with Holomatic units, using Model M60C radial machine base. The units can be mounted around the base center or standard vertical columns can be incorporated (inset). Tooling setup

with hand or air operated clamps, index tables, shuttle tables or tri-union fixtures can be adapted to the base. Hause Engineering, 809 S. Pleasant St., Montpelier, O., or —
Circle Inform-A-Gram No. A49.

Two New Ram Type Milling Machines have been developed by Van Norman Machine Co., Springfield, Mass. Models 38MA and 38MEA are reported to cut machine and operator time by as much as 40% to 50%. They feature an adjustable cutter head which permits horizontal, vertical and angular milling operations with one machine.
Circle Inform-A-Gram No. A50.

A 1½" to 5" ID Range is a feature of a plate type honing tool for high production. Hardened steel inserts are used to form the two sides of the Quick Loading honing tool. The insert reduces wear, increasing the life



of the tool. The photo shows construction and the wing type honing stone used by the tool, which was originally developed for honing connecting rods. Barnes Drill Co., 862 Chestnut St., Rockford, Ill., or —
Circle Inform-A-Gram No. A51.

Check and Indicate Pitch Diameters of Any Threaded Parts having external screw threads up to 1½" dia and of any specified pitch with a new thread checker. It needs no special wires or attachments. The device uses one pair of gaging tips for each pitch of thread to be checked. The Sheffield Corp., Div'n 710, Dayton 1, O., or —
Circle Inform-A-Gram No. A52.

For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard work track
(Optional Equipment).

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

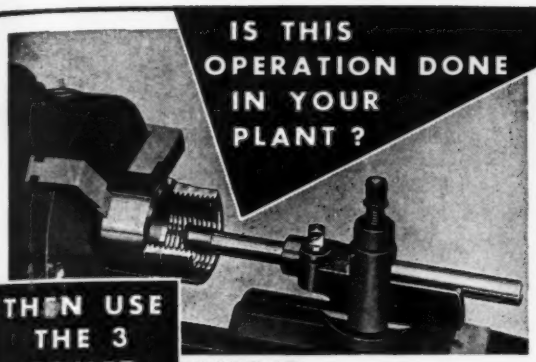
MARVEL No. 4B
HIGH SPEED HACK SAW
Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Driven.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 230



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MADE OF HIGH SPEED or CARBIDE
FOR HOLES FROM 1/16" UPWARD
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Cutting Edges are lapped for better "Bores" and Faster Feeds.

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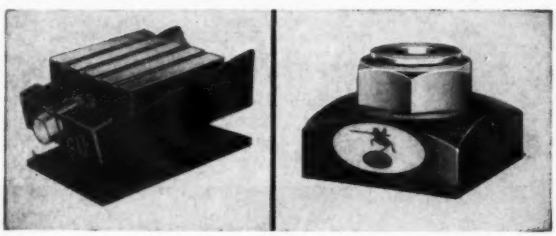
COMET Tool Co.

738-T BROADWAY, NEW YORK 3, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2311

any new machine deserves an

EMPCO *leveling jack*



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Installing new machines? *Set* them level, and *keep* them level with EMPCO Leveling Jacks. EMPCO jacks provide a solid, smoothly adjustable foundation for machine tools, large surface plates, automation lines, tool room and production equipment of all types. The result is better machine performance . . . higher precision . . . reduced downtime and maintenance. Where vibration problems exist, use VI-SORB Mounting Pads with your EMPCO Jacks. They control internal and transmitted vibration, reduce noise and prevent creepage (eliminate the need for anchor bolts in many cases). EMPCO Jacks are available in six styles, 25 models. VI-SORB Mounting Pads are cut to fit. Write us about your machine installation problems.

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EMPCO LEVELING JACKS

CIRCLE INFORM-A-GRAM KEY NO. 2312

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RAYMOND Manufacturing Co.
DIVISION OF ASSOCIATED SPRING CORPORATION
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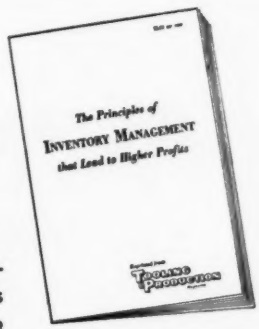
The Principles of
INVENTORY MANAGEMENT
that Lead to Higher Profits
by Nyles V. Reinfeld



. . . a 32-page treatise.

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"The techniques described require very little mathematical training, never exceeding high school algebra.

". . . experience has shown that plant personnel with very little training can learn to use these techniques on their own and will obtain very satisfactory results."

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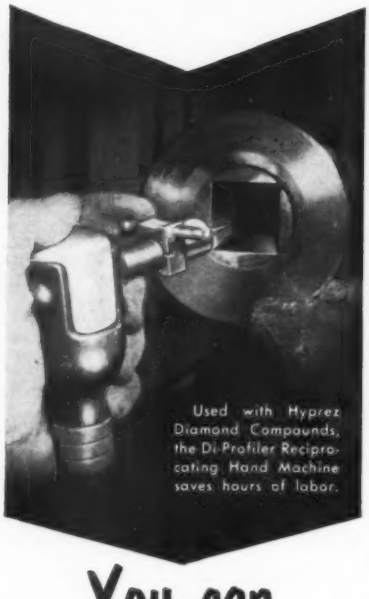

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TWIST DRILLS — REAMERS

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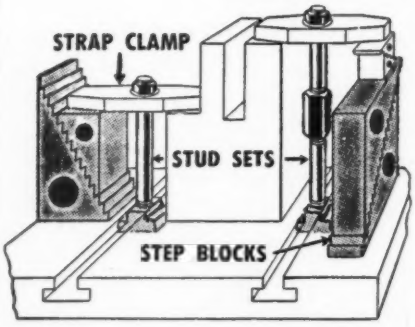

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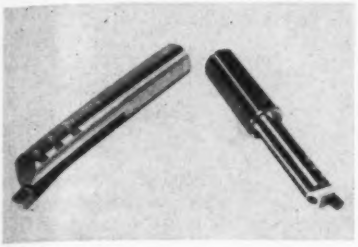
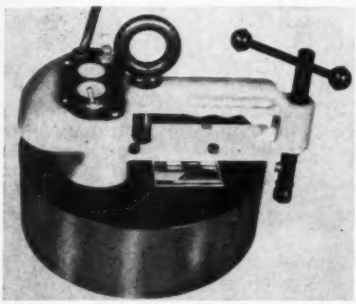
Greater Rigidity for Heavier, Faster Cuts and adjustment to tenths is provided by a new line of boring bars. The cutter is always "out front" which minimizes over-hang



and provides plenty of chip clearance. It permits the use of a bar with a bigger diameter shank for extra strength. Standard capacities range from $^{25}/_{32}$" to 6¼" in the 30 sizes. Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich., or —
Circle Inform-A-Gram No. A53.

Heavy Duty Applications in holding heavy metal plates in alignment for welding without auxiliary equipment are handled by a magnetic plate clamp. Model PH Mag-Tool

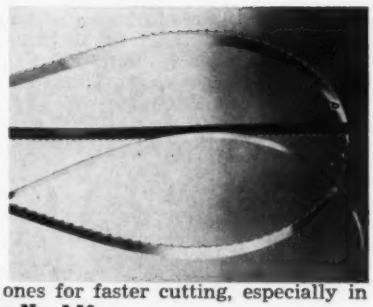


clamp exerts up to 8,500 lbs of magnetic power. It weighs only 85 lbs. Magnetic Tool Corp., 1955 Lafayette St., Santa Clara, Calif., will provide literature on Model PH Mag-Tool magnetic plate clamp, or —
Circle Inform-A-Gram No. A54.

A Solenoid-Operated Time Delay Air Valve has been developed by Beckett-Harcum Co., 1087 Wayne Rd., Wilmington, O. The Hi-Cyclic valve is suitable for any application requiring a time delay between the

release of the electric impulse on the solenoid of the air valve and the return of the cylinder to its original position. Delay time is adjustable between 0 and 30 sec, with repetition accuracy of ±10%.
Circle Inform-A-Gram No. A55.

Exceptional Cutting Performance and long life under severest on-the-job conditions are offered by an advanced line of metal cutting band saws introduced by Heller Tool Co., Newcomerstown, O. Blade widths of "Job Tempered" band saws range from ⅛" to 1". The line includes both hard edge standard steel and high speed steel saws. Standard tooth shape is provided for cutting most ferrous and hard, non-ferrous materials. Skip tooth blades are furnished



for cutting soft metals and hook tooth ones for faster cutting, especially in gummy materials. **Circle Inform-A-Gram No. A56.**

HEVI-DUTY SALT BATH FURNACES

WITH IMMERSED ELECTRODES

Built to any size or capacity with either a ceramic, welded steel, or alloy pot.

Temperatures from 300° F. to 2400° F.

SPECIAL FEATURES of the HEVI-DUTY FURNACES

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- Self-contained ceramic pot quickly removable. Ceramic, steel, or alloy pots are interchangeable.
- Electric starting coil quickly remelts the salt after a shut-down.
- Recessed electrodes permit a rolling cover, thus minimizing heat radiation from the bath surface.
- Low operating voltage eliminates shock danger.

SEND FOR BULLETIN 655 describing the other advantages of HEVI-DUTY SALT BATH FURNACES

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MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces... Electric Exclusively

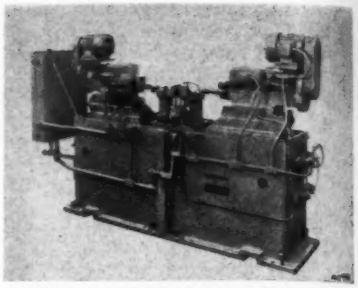
Dry Type Transformers *Constant Current Regulators*

CIRCLE INFORM-A-GRAM KEY NO. 233

Designed for Fine Straining of Air or Gases is a new low cost all brass strainer produced by Watts Regulator Co., Lawrence, Mass. Series 137 is particularly suited for keeping regulators clean. The removable strainer element strains out particles 0.004" and larger. The strainer is available in pipe sizes ¼", ⅜", and ½" and is suitable for pressures up to 500 psi.

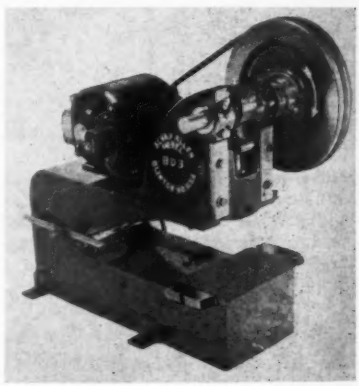
Circle Inform-A-Gram No. A57.

Drill Either 2, 5 or 6 Equally Spaced Holes arranged in a circular part with a new two-way drilling machine. Selection of number of holes to be drilled is done automatically, eliminating changeover time. Model 350-S is composed of two Morris Air-Oil-Matic drill units and an air-operated indexing fixture. It features a wide range of spindle speeds and drill sizes range to ⅝" dia. The Morris Machine Tool Co., 933-38 Harriet St., Cincinnati 3, O., or—**Circle Inform-A-Gram No. A58.**



A New Dresser with Easy-Change Cutters has been introduced by Machine Products Corp., 125 Hollier St., Dayton 3, O. The Huntington Style dresser features a handle with a bicycle grip that makes close work on high speed wheels surer and steadier. New cutters can be installed without completely dismantling the assembly.
Circle Inform-A-Gram No. A59.

Small Tonnage Operations Requiring Large Throat Space are handled by a three-ton power bench-type punch press. Model BD-3 will perform up to 300 operations/min on continuous punching, forming, blanking, cutting, etc., in any workable material within rated capacity. Standard stroke is ¾". The 12" throat is capable of punching to the center of a 24" circle. Alva Allen Industries, 1001-1015 N. 3rd St., Clinton, Mo., or —
Circle Inform-A-Gram No. A60.



A Molybdenum Disulfide Lubricant with a strong affinity for bonding to metal without building excessive accumulation on the surface has been developed. Type GX, a refinement of Type G, is an extreme pressure lubricant. The Alpha Molykote Corp., 65 Harvard Ave., Stamford, Conn., will provide additional information on Type GX lubricant, or —
Circle Inform-A-Gram No. A61.

Get America's Finest Precision
GRINDER

- air turbine drive—always runs cool
- guaranteed 75,000 RPM at 1/6 HP—holds speed under load
- weighs only 12 ounces—overall length to chuck only 5-1/2"
- precision built for trouble-free, continuous operation
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ONCE YOU TRY THIS GRINDER we're sure you wouldn't sell it for THREE TIMES its PRICE!

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It's NEW! 3000 SERIES BURR-RITE *Sr.*

NEW MACHINE
NEW MEDIA
Reduce Your Deburring Costs

● Is DEBURRING required on your products? Do you realize the savings that can be made by the Barrel Finishing process? Write us today and get full details about this new, improved machine. SEE its value on your parts . . . Send samples for free processing today.

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The Powerful **NEW** Hi-Torque

HANDEE®

FOR DIE TOUCH-UP WORK

A COMPLETE WORKSHOP IN YOUR HAND

Grinds, polishes, cuts, saws, engraves, cleans and burnishes. Can be used for working in wood, hardened steel, non-ferrous metals, glass, ceramics, etc. A big time-saving tool for light production grinding and touch-up for all shops, tool and die plants, foundries, etc.

The new Hi-Torque Handee is packed with speed (25,000 r.p.m.) and power. Perfectly balanced, cool running, fits the hand for pencil point precision in delicate work. New chuck lock design for quick change of accessories. Available in 110 or 220 volt, 25 to 60 cycles.

with 6 accessories
$23.95

With every type of cutting tool in metal case $32.95

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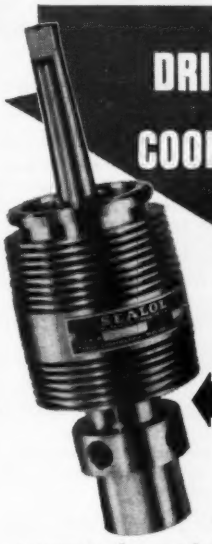
DRILL PRECISION HOLES IN ONE PASS

Gun Drilling Does It

WITH SEALOL'S
DRILL ADAPTOR
AND
COOLANT SUPPLY UNIT

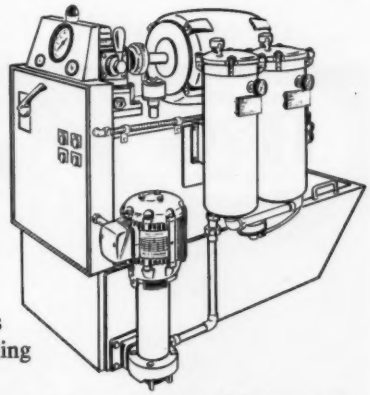


Deep or shallow precision holes in one pass . . . without those profit-cutting steps of boring, reaming or honing.

SEALOL DRILL ADAPTOR — converts your regular, solid-spindle drilling equipment for precision gun drilling of all types.

Transfers coolant from a stationary source to the rotating gun drill at speeds to 10,000 rpm — pressures to 1,000 psi. Coolant is delivered through the gun drill directly to the cutting edge. Work runs cooler; drills cut faster, more accurately and with less power.

SEALOL HI-PRESSURE COOLANT SUPPLY UNIT — provides a high volume of micro-clean coolant at proper pressures and volumes for precision drilling of *all* types.



Filters, cools and pumps coolant to drill adaptor at pressures to 1,000 psi — volume to 40 gpm (higher capacities available) for modern gun or oil-hole drilling.

MAIL THIS COUPON TODAY!

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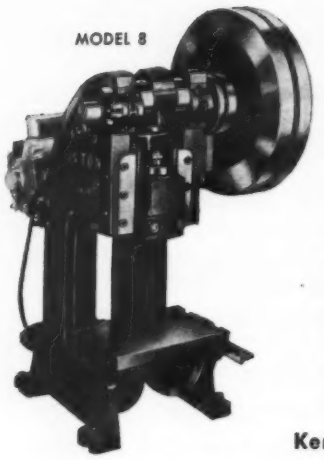
CIRCLE INFORM-A-GRAM KEY NO. 2353

KENCO 8-TON
PRECISION-BUILT
PUNCH PRESSES

MODEL 8



. . . rugged, fast and trouble-free

They're Kenco-built with long-wearing parts *throughout* to eliminate downtime and give you *many extra* years of steady, low-cost production. Rigid, multiple-rib frames and extremely long ram ways assure high precision production. Driving mechanism engineered for trouble-free operation. Press is competitively priced.

Model 8-R—8-ton deep-throat, Rigid-Rib

Same construction features, but with 12¾" throat, and tremendous resistance to breakage, deflection, or torsional twist.

Kenco presses—14 models—2 to 15 tons

Write for literature

KENCO MANUFACTURING CO.

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STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

On Brown and Sharpe, and other automatics.

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $45 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.

FREE: "Unified and American Screw Thread Digest"

THE EASTERN MACHINE SCREW CORPORATION 29-49 Barclay St., New Haven, Conn.

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Stay Ahead in Your SPRAY DECORATING

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Standard and special automatic and semi-automatic machines for decorating parts of all sizes, shapes. High production with small investment. Skilled operators unnecessary. Automatic clamping and ejection of parts. Adjustable sequence-type operation. Hydraulic two-fluid control system maintains accurate repeats and eliminates cost of explosion-proof controls. Paint in one or two directions. Steady, hydraulic controlled gun movement.

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Toledo 2, Ohio

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LEIGH POCKET TOOLS

Approx. ½" length of carbide.
RESHARPEN points. Reverse for PERSONAL SAFETY.

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Spring Specialty Co.
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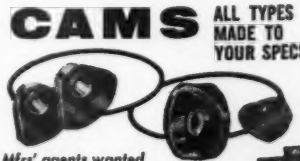
CAMS ALL TYPES MADE TO YOUR SPECS



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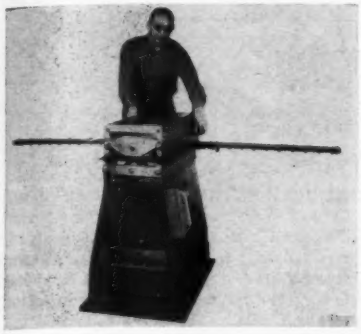
EISLER ENGINEERING CO., INC.
732 SO. 13TH ST. NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2365

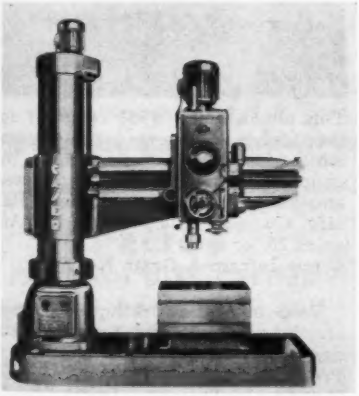
Slit Sheets or Coil Stock from 24 to 10 Ga. at speeds up to 60 fpm with a rotary slitting shear. Model 1025 features a 25" throat depth and 1½" minimum width of cut. The



cutting edge of the blade can be resharpened many times. The housing of the machine is adjustable for height from 32" to 36". The Flagler Corp., 19321 Filer Ave., Detroit 34, or—**Circle Inform-A-Gram No. A62.**

Join Many Types of Aluminum Alloys with a self-fluxing brazing alloy produced by Handy & Harman, 82 Fulton St., New York 38. Alumibraze, supplied as a dry powder and applied as an aqueous slurry, is designed for use in a molten salt bath. It is painted on, stays put and provides a convenient way of repairing joints. The brazing alloy contains its own fluxing material which serves both as a flux and as a cement. It melts in the range of 1070°F to 1080°F and is generally brazed at 1100°F. **Circle No. A63.**

While This Radial Drill Is Running and the tool is engaged, the feed dial can be turned to a new setting. The feed-selector dial has a built-in feed and speed chart. Caser Model F25



has a drilling capacity in steel of 1" and in cast iron of 1⅜". The spindle has eight speeds ranging from 205 to 2300 rpm with three feeds. Maserati Corp. of America, 662 Main St., Westbury, L. I., N. Y., or —
Circle Inform-A-Gram No. A64.

Spindle Speeds of 10,000 Rpm are a feature of two new versions of Brown & Sharpe No. 00 automatic screw machine. They assure increased efficiency on free-machining materials with a wide range of lower speeds for efficient operation on the tougher alloys. Type 1 has a turret and vertical slide and Type 2 omits the vertical slide and the turret is replaced by a one-tool position slide. Both have full ½" capacity. Brown & Sharpe Mfg. Co., Providence 1, R. I., or —
Circle Inform-A-Gram No. A65.

Automate your new press lines to operate them at full capacity!

MPE can help you automate any part of your press lines . . .

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. . . THE UNLOADING

. . . THE STACKING

. . . THE TRANSFERRING

It's Easy to do! Just send sketch of area; size, shape and cut of blank; press type and capacity —and, we'll send you our proposal.

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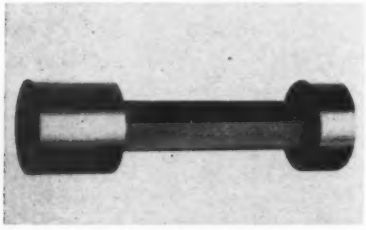
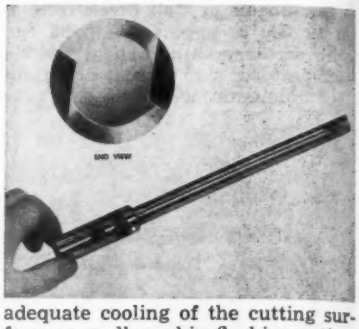
1796 E. 9 Mile Road • Hazel Park, Michigan
CIRCLE INFORM-A-GRAM KEY NO. 237

Longer-Wearing Plain Plug Gages are being made by Rite-O Tool and Gage Co., 321 W. 10 Mile Rd., Hazel Park, Mich. Ritoloy gages are reported to wear as long as solid carbide gages but cost only one-third as much. They have a surface made of extremely hard, wear-resistant nickel alloy. The Ritoloy gages have a very low coefficient of friction and are non-magnetic and non-sparking. **Circle Inform-A-Gram No. A66.**



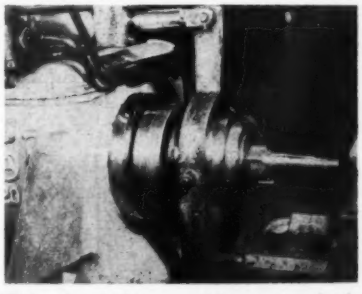
Produce Close-Tolerance, High Surface Finish Holes with a new carbide-tipped reamer. The Starbore reamer combines the production advantages of a gun drill with those of a carbide reamer. Coolant under pressure is directed through the shank into the two flutes to provide



adequate cooling of the cutting surfaces as well as chip flushing action. The tool will ream precision holes in cast iron, bronze, aluminum and steel parts. Star Cutter Co., 34500 Grand River Ave., Farmington, Mich., or —
Circle Inform-A-Gram No. A67.

A High Strength, Ductile, Easy-Flowing Electrode and Filler Rod, Ampco-Trode 40, has been developed for the repair and fabrication of a new manganese-aluminum bronze casting alloy, Superston 40. It is also adaptable for use in the repair welding of high strength cast irons. The deposit is highly resistant to wear and corrosion. Ampco Metal, Inc., Milwaukee 46, or —
Circle Inform-A-Gram No. A68.

Powerful Gripping on Tough Production Jobs is performed by a 3" collet chuck. Model C will hold down 20 hp or more. It can be adapted to threaded spindles with a small amount of tooling and can also be used for holding thin walled tubing.

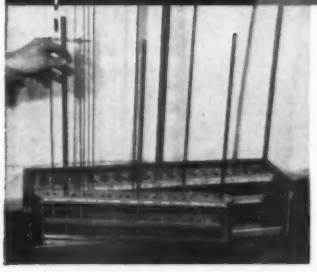


This chuck has a wide range of adjustment. Work can be changed while the lathe is running. The chuck can be operated by hand lever, and air or hydraulic cylinder. Hall Mfg. Co., 622 Tularosa Dr., Los Angeles 26, or —
Circle Inform-A-Gram No. A69.

Used in Metalworking Operations are the ceramic permanent magnetic assemblies fabricated by Storch Products Co., Inc., 9232 Greenfield, Detroit 28. They are available in all shapes and sizes from round through contoured forms and can be machined for any application. The ceramic assemblies feature Indox magnets which have maximum resistance to demagnetizing fields.
Circle Inform-A-Gram No. A70.

SAVE TIME AND MONEY 3 WAYS WITH ACRO DRILL ROD RACKS

Full size rack, holds 494 pieces of 133 sizes, fractional, number and letter sizes.
Fractional racks, 47 sizes, 138 pieces.
Modified rack, holds 47 fractional sizes, 138 pieces.



Eliminate trouble and waste effort with this modern method of storing drill rod. Put the Acro rack in a central location and make it simple for each mechanic to select correct rod size in a hurry. Provides a visual inventory for checking rod replacements.

ACRO DRILL ROD RACKS accommodate:
26 letter sizes, 52 pieces
47 fractional sizes, 138 pieces
60 number sizes, 304 pieces

Note: Fractional sizes graduated in 64ths from 1/32" to 1/2" and in 32nds from 1/2" to 1" included.

The Acro Drill Rod Rack saves three ways:

1. Saves time in selecting and replacing drill rod. Unnecessary individual shop trips to tool cribs for the purpose of obtaining small amounts of drill rod are eliminated.
2. Saves valuable shop space. Unique swing-gate construction confines 133 sizes, 494 individual pieces in an area of 26" long x 13½" wide. Adaptable to tool makers bench, foreman's office or any other convenient location.
3. Eliminates cost of machining large rod to smaller size due to error in replacing stock. Accuracy in selection is insured because each group of apertures is plainly marked as to size with its decimal equivalent in black numerals on a white background.

FREE DATA on these racks and other Acro time-saving products is available on request. Write for Bulletin DR-57.

ACRO METAL STAMPING CO.
336 E. RESERVOIR AVE., MILWAUKEE 12, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 238

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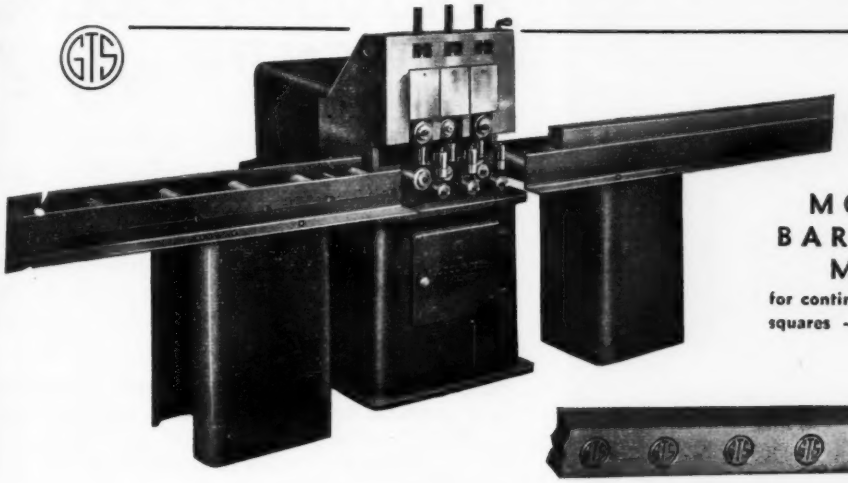

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BAR MARKING
MACHINE

for continuous marking on flats — squares — rounds — octagonals

Simple horizontal and vertical adjustments on this unit fix the work for precision operation. Bars may be marked on one side only or on opposite faces. Intermittent marking is obtainable at desired intervals up to 9 in. Lettering knurls can be quickly changed by removing a single screw. Feed and discharge roller bearing tables are available with the unit.
Write today for full information on Model 295, or any part of the famous GTS line of marking equipment.

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CIRCLE INFORM-A-GRAM KEY NO. 2394

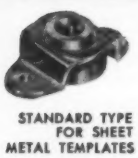
ANCHOR BUSHING DRILL TEMPLATES HOLD DOWN TOOLING COSTS ON THE *Ag-2*

Manufacturing costs are closely watched on Transland Company's new, production designed Ag-2 agricultural and forestry airplane.

Inexpensive, lightweight, Anchor Bushing drill templates provide low cost drill tooling for the complete interchangeability of parts for production and spares for the Ag-2's service program.

Photo shows an easy-to-make Anchor Bushing drill template being used to locate and drill holes for Blind Nuts in the six fuel and liquid wing tank bays and matching holes in interchangeable tank covers.

Write for the Anchor Bushing Catalog for descriptions of Anchor Bushings and shop proven methods for making low cost sheet metal and plastic drill tooling.



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Completely versatile. Available as a basic unit for production inspection or as a completely equipped contour measuring projector.

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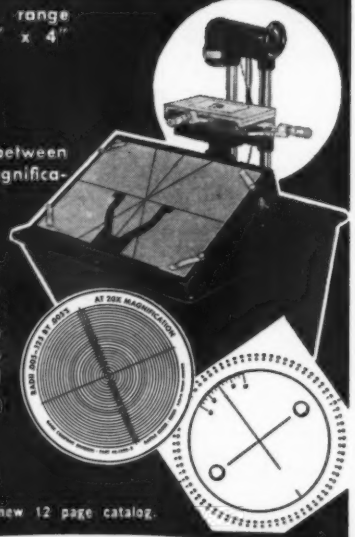

Write for FREE new 12 page catalog.

OPTO-METRIC TOOLS, INC.
137 TP-5 VARICK STREET, NEW YORK 13, N. Y.

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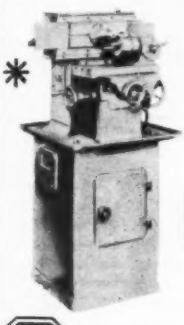

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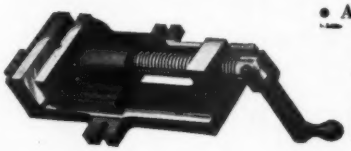

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No.	Jaw Width	Max. Opening
1D	3½"	4"
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- **Does away with special and costly jig fixtures.**
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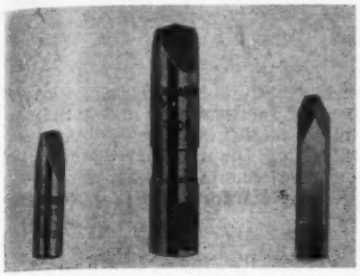
YOST MFG. CO. 124 Grant St., Cambridge Springs, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 2404

A New Line of Shaped Diamond Tools is being offered by Craine-Schwartz Diamond Tool Co., 8100 Lyndon, Detroit 38. They are designed to permit reproduction of the "pine tree" and other root sections

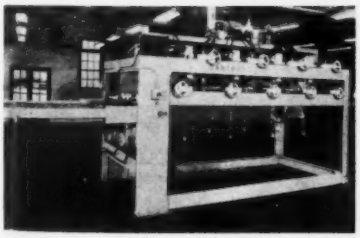


of jet blades and buckets on two-wheel precision form grinder. Characteristic of the tools is the triangular-shaped macle diamond used. Shown are three types of special jet tools produced by the company.
Circle Inform-A-Gram No. A71.

Stepless Speeds from True Zero to 400 Rpm are provided by a motorized speed reducer. This package unit saves time in buying, installation and servicing. Instant speed changes can

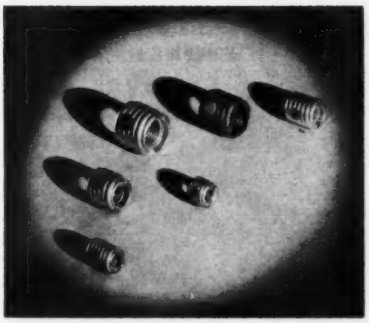
be made while the unit is running or stopped. The speed reducer serves as a reliable drive wherever fractional hp variable speed is required. Revco, Inc., 1900 Lyndale Ave., S., Minneapolis, or —
Circle Inform-A-Gram No. A72.

Feed Heavy Gauge Sheet Steel to processing equipment such as punch presses, shot blasters, roll formers, slitters and trimmers with a new machine. It handles sheet approximately ⅛" thick, eliminating handling of



individual sheets. Feeders can be constructed for sheets of any size. The one shown handles sheets 42" wide by 120" long. Dexter Folder Co., 219 E. 44th St., New York, or —
Circle Inform-A-Gram No. A73.

An Increased Range of Nylok Self-Locking Threaded Inserts has been announced by The Nylok Corp., 611 Industrial Ave., Paramus, N. J. Sizes are now available as small as No. 0. The inserts eliminate the need for special tools, tape or counterboring, and can be installed in a standard threaded hole and removed with a screwdriver. The self-locking principle provides a locking action on both internal and external threads. They cannot shake loose under severe conditions of vibration and can be reused many times without appreciable reduction in torque.



Circle Inform-A-Gram No. A74.

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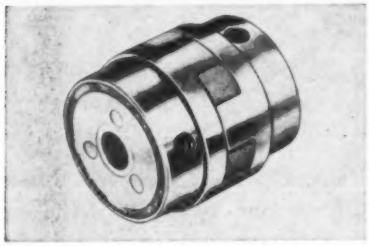
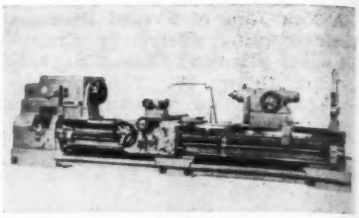
CIRCLE INFORM-A-GRAM KEY NO. 241

Designed for Low Cost Original Equipment Installation is a zinc die cast flexible coupling. Type L-093 consists of two bodies with jaws and a one-piece spider-type cushion. Dust, dirt, mud, water or similar adverse conditions have no effect on performance. Ratings for the coupling range from 0.4 hp at 100 rpm to 4.6 hp at 3600 rpm, using standard cushions. Lovejoy Flexible Coupling Co., 4979 W. Lake St., Chicago 44, or —
Circle Inform-A-Gram No. A75.



Used with Equal Effectiveness on Rough or Precision Cuts is this heavy-duty lathe. Model 4025 features a 75 hp headstock and 24 spindle speeds. It has a capacity of 40" of swing over the bedways and 25" over the cross-slide. There are 81 feeds, ranging from 0.005" to 0.351" per spindle revolution and 45 threads from 1 to 30/in can be cut. Axelson Mfg. Co., Div'n of U.S. Industries, Inc., 5947 Sheila St., Los Angeles 22, or—**Circle Inform-A-Gram No. A76.**



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includes a 2" and 3" head, 2 long and 2 short tool bits... Boring range 2-3/4" to 5-1/4" dia.

WRITE FOR LITERATURE AND PRICES

PDQ **PORTAGE Double-Quick, Inc.**

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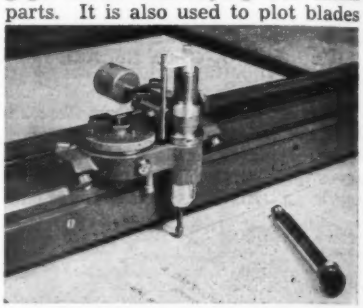
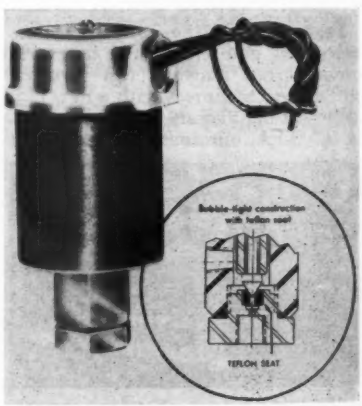
CIRCLE INFORM-A-GRAM KEY NO. 242

Precise Plotting is performed by the Coordinatograph. It plots points along X and Y coordinates within 0.001" and is used for aircraft lofting, gage charts and laying out small parts. It is also used to plot blades in a stock or flow patterns for turbine blades. The pricker point unit has a 7-power microscope so that the point can be observed and plotted in a single setup. Aero Service Corp., 210 E. Courtland St., Philadelphia 20, or —
Circle Inform-A-Gram No. A77.



Bubble Tight at 5,000 Psi is a stainless steel solenoid valve. Model SBTDW features a newly-designed Teflon seat that eliminates metal-to-metal seal. The solenoid valve is suited to applications where high pressure is combined with relatively little flow. Atkomatic Valve Co., Inc., 545 W. Abbott St., Indianapolis 25, or—**Circle Inform-A-Gram No. A78.**



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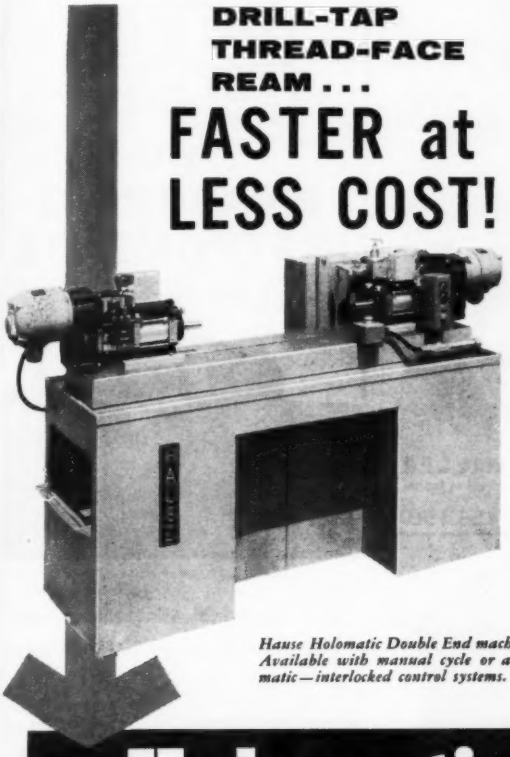

Hause Holomatic Double End machine. Available with manual cycle or automatic—interlocked control systems.

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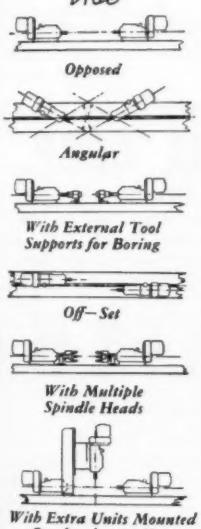
Methods of Use



● Hause Holomatic Double End machines are designed specifically to perform *two or more* drilling, tapping, threading, reaming, thread rolling, chamfering, spot facing—or similar operations *at one time.*

Holomatic units use factory air supplies for thrust power and a self-contained hydraulic system provides positive, infinitely adjustable control of the rapid travel and feed movements of the quill.

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■ Measures plated coatings on steel, brass, copper, zinc die-cast, aluminum, bronze and other metals; also, nickel on steel. ■ Measures anodize and hard-coat on aluminum and magnesium; also, paint, porcelain, organic coatings on non-ferrous metals. ■ Measures metal coatings on plastics, ceramics and other non-metallic materials. ■ Available with FOUR measuring probes for extra-wide thickness ranges from thin to thick deposits. ■ Only ⅛″ circle area required for measurement. ■ You get fast, accurate, direct readings, plus versatility and portability. ■ Sorts metals and alloys.

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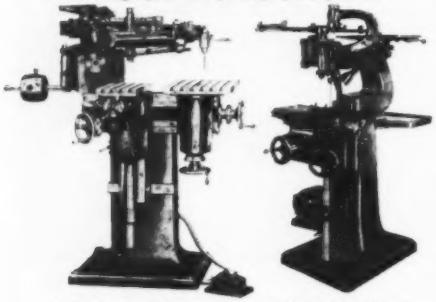

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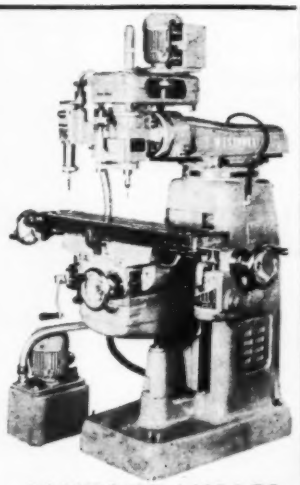

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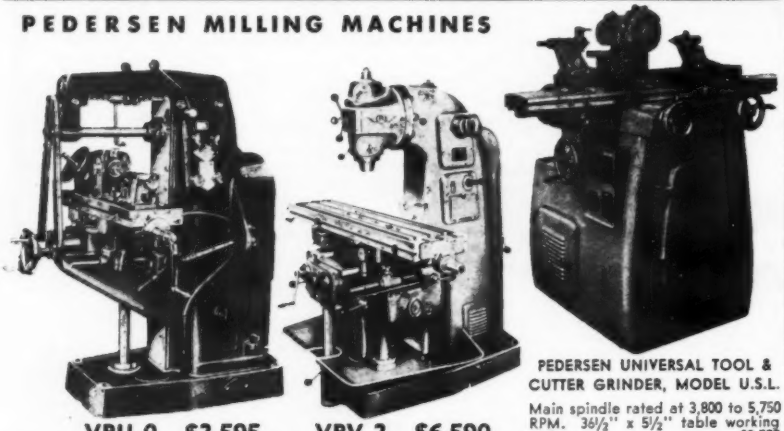

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Main spindle rated at 3,800 to 5,750 RPM. 3½" x 5½" table working surface. $2,595

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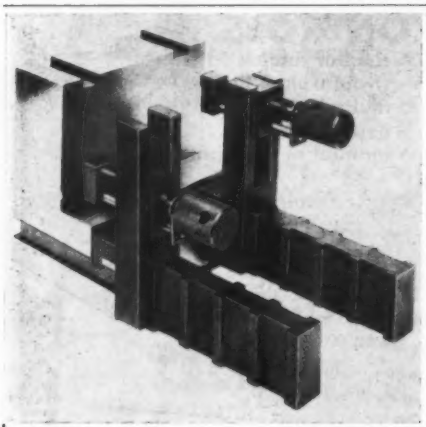

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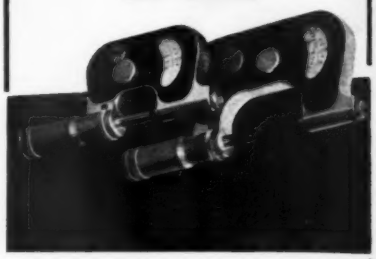
KEARSARGE TOOL & MFG. CO. ERIE, PA.

CIRCLE INFORM-A-GRAM KEY NO. 2442

CARL ZEISS JENA

TWO MEASURING INSTRUMENTS IN ONE



A Precision Indicating Micrometer and An Adjustable Snap Gauge

In two sizes: 0-1 inch and 1-2 inch

- Indicator reading directory to 0.0001 in.
- Eliminates errors of "feel" • Adjustable tolerance indicators • Movable anvil for limit gaging • Cemented carbide measuring surfaces • Universal fixture for holding micrometers available.

This is only one of a full line of industrial precision measuring instruments.

For further information on this and other Carl Zeiss, Jena instruments, consult your dealer or write us.

Scientific Instrument Division

ERCONA CORP.

551 Fifth Ave., New York 17, N. Y.

Exclusive American Representative for VEB Carl Zeiss, Jena

CIRCLE INFORM-A-GRAM KEY NO. 2443

CAMS

To Your Specifications

• • • • •

— Except Screw Machine Cams —

• • • • •

Design Assistance Offered

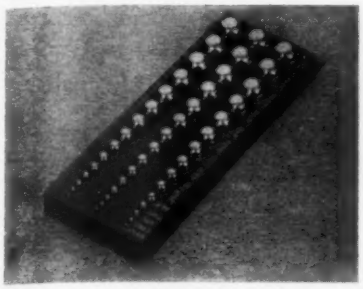
KIDDE PRECISION TOOL CORPORATION

10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2444

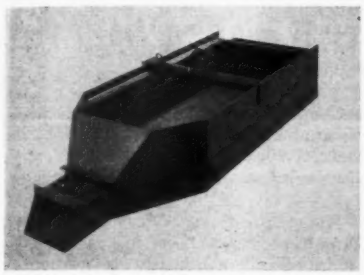
BUY U. S. SAVINGS BONDS

Precision Micro-Balls for sizing and gaging have been added to the line of gaging products manufactured by Deltronic Corp., 1507-1509 Riverside Dr., Los Angeles 31. Matched



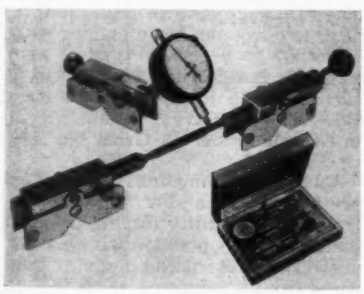
balls range in size from 1/16" to 1/2" dia and are made to a tolerance of 0.000025". There are 15 sizes, 3 balls of each size, in a permanent carrying case.
Circle Inform-A-Gram No. A79.

Speed Up Loading of Chips and Other Barrel Finishing Media with hoist pans produced by Lord Chemical Corp., York, Pa. The four welded



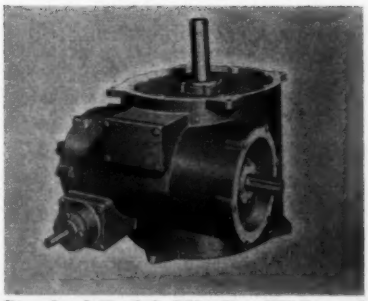
steel pans, ranging in capacity from 4 to 14 cu ft, are fitted with either rollers or roller-bearing wheels. A balanced yoke at the top provides for crane or hoist hook.
Circle Inform-A-Gram No. A80.

A Concentricity Gage Mounted in a Magnetized Holder has been introduced by Clark Engineering and Mfg. Co., 1820 Layard Ave., Racine, Wis. It can be used in unlimited locations



and positions, on drill presses, boring tools and lathes, in toolrooms and for inspection and production operations. The gage provides quick, easy accurate setup for checking concentricity of shafts.
Circle Inform-A-Gram No. A81.

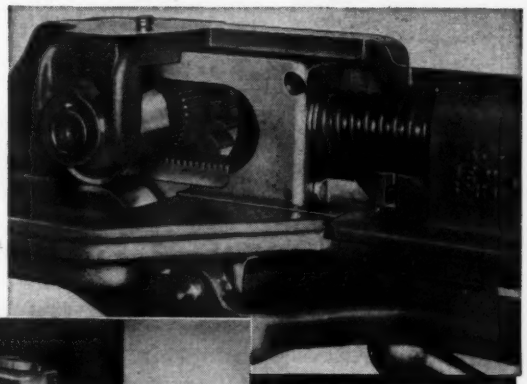
Precision Indexing between Automatic Production Stations is provided by a heavy duty cam operated indexing unit. It is also a simplified means of timing production operation drives. The unit can reduce machine design time by as much as 50% by designing the machine around the index stops provided. Typical applications include automatic manufacture of component parts, automatic assembly of electrical or mechanical components, and positioning for multiple operations on parts or equipment.

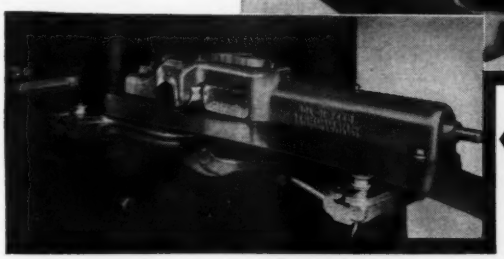


Standard Tool & Mfg Co., 237 Laurel Ave., Kearney, N. J., or — **Circle Inform-A-Gram No. A82.**

Big Feeds...Big Production...Big Profits...

at SMALL COST!....

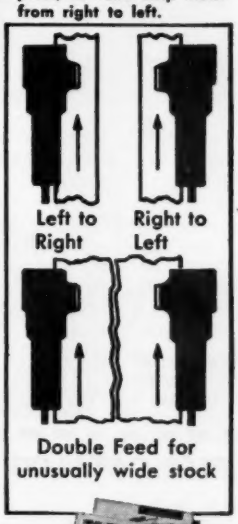




Dickerman 12" Rol-Di-Feed, conventionally mounted on the bolster of a punch press, to feed strip stock from right to left.

Here's a new, versatile feed designed to outperform others costing up to 8 times more! The Dickerman 12" Rol-Di-Feed is easily installed on any punch press. This new feed handles with equal ease such different materials as paper, plastic, or cold rolled steel—in thicknesses ranging from .003" to 3/16" in any type of die—piercing, blanking, compound, progressive or draw. The 12" Rol-Di-Feed feeds on the press upstroke and on the downstroke, permitting accurate stock feeds up to 12" per cycle.

Open side design accommodates stock of almost any width. 12" Rol-Di-Feed can be mounted to feed in any direction . . . or installed in pairs to handle unusual sizes and types of stock. For greater production and profits, eliminate costly "special" feeds—install the new standard Dickerman 12" Rol-Di-Feed on all your press equipment!

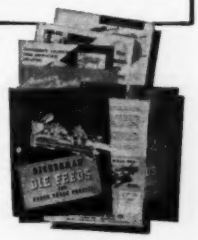


Dickerman

H. E. DICKERMAN MFG. CO.

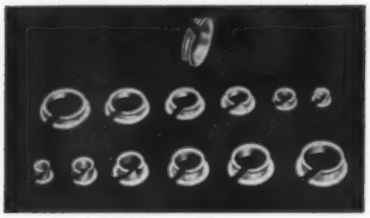
321-305 Albany Street • Springfield, Mass.

Send today for literature on the complete Dickerman line.



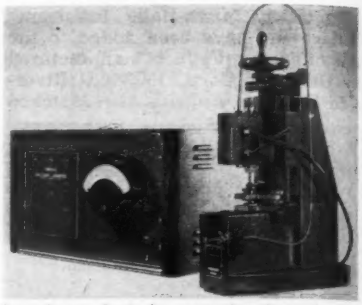
CIRCLE INFORM-A-GRAM KEY NO. 245

A New Type Nylon Bearing is being manufactured by Thomson Industries, Inc., Manhasset, N. Y. Type 7 Snap-In Nyliners have a flange on both ends which retains the bearing in a hole in sheet metal or thin plates



of any material. The bearings eliminate lubrication, damp mechanical vibration and increase bearing life. They are manufactured in two lengths, one for plate thickness from 0.040" to 0.075" and the other for thickness from 0.072" to 0.135". There are nine sizes of each and bore diameters range from ⅛" to ¾". **Circle Inform-A-Gram No. A83.**

Dimensional Variations of One Millionth of an Inch can be detected with a super-sensitive electronic comparator. Model 130 B-9 was originally built to measure precision ball



bearings, but is completely adjustable and can be used for parts of various shapes and sizes. Its design permits measuring with a minimum gaging pressure so that thin-walled or highly polished parts can be measured without distortion or marking. Gage capacity is adjustable over a wide range. Federal Products Corp., 1144 Eddy St., Providence 1, R. I., or—**Circle Inform-A-Gram No. A84.**

Process Blanks Successively from a loaded stack with an automatic sheet feeder and scrap ejector. It can be adapted to take a wide range of sheet sizes and thicknesses. Sheets are picked up from the stack by a vacuum lift and deposited in a transfer carriage which feeds them through the press. The sheet feeder is positioned on rails permitting full access to the press for die removal. Hautau Engineering Co., 721 Wanda, Detroit 20, or — **Circle Inform-A-Gram No. A85.**

High Speed Centerless Round Bar Turning with carbon or oxide cutting tools is performed by a centerless bar turner. No. 4 Medart RFPD applies the torque chipper method of centerless turning to bars 4½" dia.

The PD machines are offered in three sizes to cover the bar diameter range from ⅜" to 6". Any type of alloy steel or non-ferrous metal can be turned by the machines. Blaw-Knox Co., 300 - 6th Ave., Pittsburgh 22, or—**Circle Inform-A-Gram No. A86.**

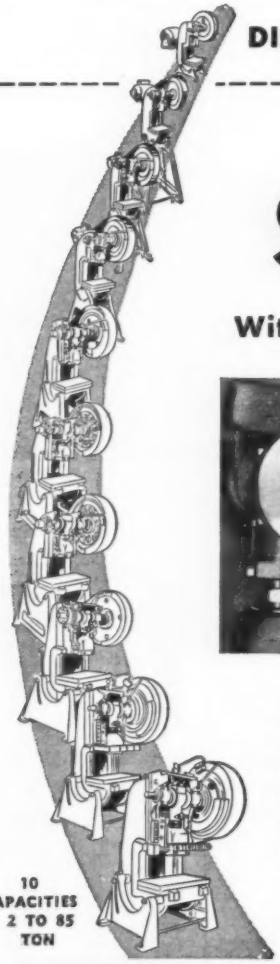
Custom Forming Jobs of Any Kind are handled by a new "absolute control" 200-ton utility forcing press. It loads from any position within a 300° arc. The press accommodates pressures from a gentle pinch to the full 200-ton squeeze. The head is T-slotted for quick change of standard or special tools. The table is also provided with T-slots for anchoring work and tools. Fjellman American, Inc., Joliet, Ill., or — **Circle Inform-A-Gram No. A87.**

DISCOVER THE "*difference*"

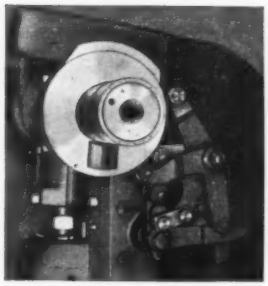
in

SAFETY

With PRESS-RITE POWER PRESSES



10 CAPACITIES 2 TO 85 TON



PRESS-RITE Single Stroke Non-Repeat Mechanism is operated mechanically with two positive cams . . . a superior design found only on PRESS-RITE PRESSES!

More and more press users are standardizing with PRESS-RITE'S because of SAFETY. The PRESS-RITE Single Stroke Non-Repeat Mechanism is the safest on presses today. Operators have confidence in PRESS-RITE PRESSES. This keeps efficiency and production high . . . and insurance rates low! Make your next press . . . PRESS-RITE . . . and be safe! Air operated clutch and brake also available, optional.

Press-Rite Division of Sales Service Machine Tool Company, 2351 University Avenue, St. Paul, W14, Minnesota.

FREE CATALOG Write for Press-Rite catalog No. 855 with illustrations and specifications of all models, 2 to 85 ton capacity.

USED BY MORE . . . FOR MORE PRODUCTION

PRESS-RITE

OPEN BACK • INCLINABLE *Power Presses*

CIRCLE INFORM-A-GRAM KEY NO. 246

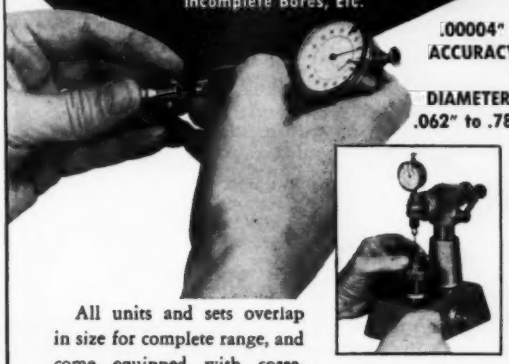
ARROW TOOL & REAMER CO. • Established 1916

Manufacturing skill and tool making experience for over 37 years — adds up to preference for Arrow End Mills.

ARROW TOOL & REAMER CO.
711 Stephenson Highway
P. O. Box 338 • Troy, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2471

DIATEST High Precision BORE GAUGE
Eliminates Need for All Special Hole Gauges!
MEASURES ALL BORES
Out of Round, Tapered, Barrel Shaped, Incomplete Bores, Etc.



All units and sets overlap in size for complete range, and come equipped with corresponding Ring Gauges as comparators. Exact continuous readings are indicated on large dial.

FOSTER SUPPLIES CO., 6122 Milwaukee Ave., Chicago 30, Ill.
Gentlemen: We are interested in additional information on your New DIATEST Bore Gauge.
NAME_____POSITION_____
FIRM_____
ADDRESS_____
CITY_____STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 2473

PINPOINT MACHINE WEAR . . .
MISMATED PARTS . . . WITH
SPERRY BEARING TESTER

The Bearing Tester consists of a metal probe, or pickup, and a compact electronic amplifier. Any malfunctioning in a moving part is transmitted through the probe and shows itself by a change in the noise level and the noise pattern visually presented on the tester's calibrated dial. Lightweight, easily portable, the Sperry Bearing Tester is a positive asset to preventive maintenance, quality control, and receiving inspection.

Bulletin 61-105 describes the Sperry Bearing Tester. Write for your copy.

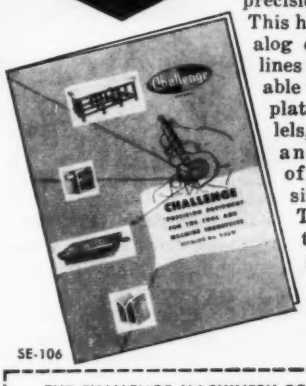
405 Shelter Rock Road Danbury, Connecticut

sperry products INC.
First in Ultrasonic Inspection

CIRCLE INFORM-A-GRAM KEY NO. 2472

Get this HANDY BUYING GUIDE
for all your PRECISION
SURFACE EQUIPMENT NEEDS

Here's the easy way to fill your precision surface equipment needs! This handy 16 page condensed catalog covers one of the broadest lines of surface equipment available today. Surface plates, bench plates, angle plates, box parallels, V-blocks, straight edges and many other types are offered in many standard sizes and with *prices shown*. They are easily available, too, from your local mill supply distributor. Get your copy from your local distributor or write



SE-106

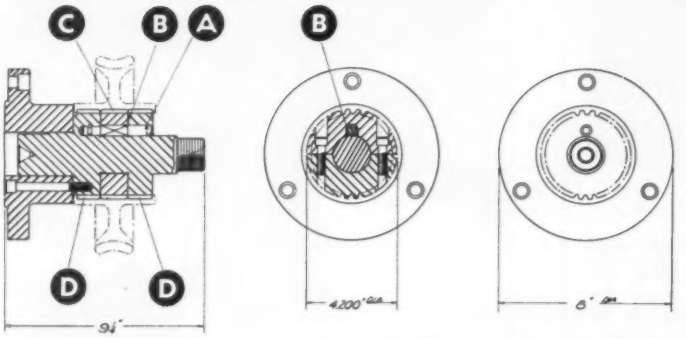
Challenge®

THE CHALLENGE MACHINERY COMPANY TP-5
Grand Haven, Michigan
Please send your latest Challenge Precision Equipment Catalog No. 838W.
Name_____Title_____
Company_____
Address_____

CIRCLE INFORM-A-GRAM KEY NO. 2474

For Your Gear Concentricity and Squareness Problems . . .

THE "MASTER SPLINE" LOCKING SPLINE IMPROVED ARBOR



The "MASTER SPLINE" Improved Locking Spline arbor construction is simple, positive, and the action speedy. Turning the eccentric "A" forces the cam section "B" to rotate the locking ring section "C", clamping the work piece on each spline tooth. This clamping action centers the work piece concentric and square to the pitch diameter of the spline.

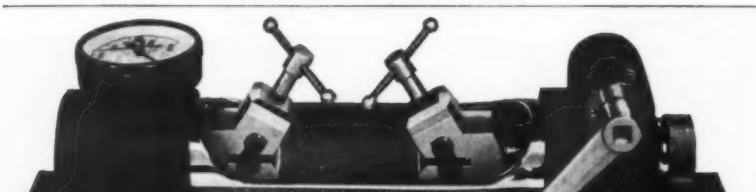
When the cam rod "A" is returned to its original position, the cam "B" returns the locking ring "C" back into alignment with the two fixed splines "D", thus releasing the work piece.

The Master Spline Tool and Gage Company also manufactures to specification — Taper Spline Arbors — Straight Arbors (with splines tapered on one or both sides) — Master Gears — Spline Plug Gages — Gear Dies and Punches, Jigs, Gages, Fixtures, Tools and Indexing Equipment.

MASTER SPLINE TOOL and GAGE COMPANY

30055 W. Eight Mile Road — Livonia, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2481



For shop or field—a new

Portable Tensile Tester

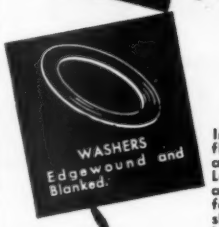
Use this compact, precision tensile tester to test strip steel, wire, bolts, spot welds, or anything else within its 4,000 lb. capacity. Besides its use for inspection work in the shop, this portable device provides a convincing method of demonstrating the tensile strength of various materials in sales demonstrations and trade shows.

Only a moderate pull on the crank is sufficient to apply the maximum load. Results are easily read from the load gauge. Simple to use, anywhere, any time. Write for catalog sheet and price.

DETROIT TESTING MACHINE COMPANY

9386 Grinnell Avenue Detroit 13, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2482



IT'S A SNAP with LUCAS-MILHAUPT SILVER BRAZING PREFORMS

In addition to round and flat wire rings, blanked and edgewound washers, Lucas-Milhaupt provides a complete line of preforms which include such shapes as elliptical, rings, hinged rings, segments, slugs, U clips, hairpins, etc.

Send your drawings or sample part and the proper preform will be designed to do your brazing job faster at less cost.

Preforms in any size or shape that . . .

- End Wasted Time in Placing Silver Solder in position for brazing.
- Speed Assembly Work.
- Eliminate Rejects.
- Meter Silver Solder to Flow In and Around Joints.

FREE . . .

16 page booklet gives you all the facts on better brazing with preforms. Write Today!

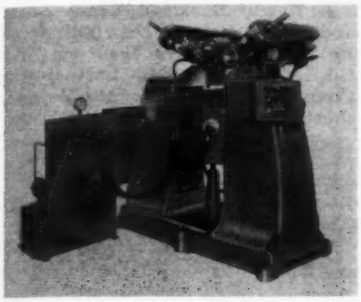
LUCAS MILHAUPT ENGINEERING COMPANY

5090 So. Lake Drive • Cudahy, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 2483

A New Battery-Charger Unit is now mounted on Automatic Transporter operator-led electric-driven industrial trucks. Since the charger can be plugged into any 115 volt, 60 cycle AC lighting circuit without disconnecting the battery truck lead connector, the battery can be recharged any time the truck is not in use. The need for a central charging point is eliminated. Automatic Transportation Co., 149 W. 87th St., Chicago 20, or —
Circle Inform-A-Gram No. A88.

Milling, Drilling, Grinding, Boring or Special Applications are performed by the U.S. Hy-Flex double-column hydraulic production milling machine. It is equipped with independent milling heads which can be

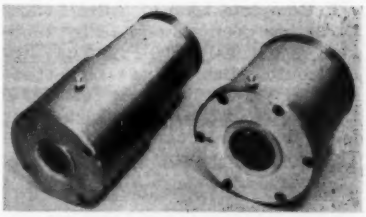


mounted in the desired position, providing great milling flexibility. The table has a 30" maximum table stroke. U.S. Burke Machine Tool Div'n, 7 Brotherton Rd., Cincinnati 27, O., or —
Circle Inform-A-Gram No. A89.

The Nichols Twin Mill now has dovetail slides with micro-feed screws for six-way longitudinal adjustment of each milling head. The Twin Mill is a two-spindle, bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces using horizontal or vertical spindles. Each head operates independently. Spindle speeds range from 55 to 2050 rpm. The Robert E. Morris Co., Farmington Ave., W. Hartford, Conn., or —
Circle Inform-A-Gram No. A90.

Designed for Grinding and Polishing Large Diameter Tanks are three new coated abrasive belt machines. The seam weld grinder and polisher will handle seam welds on flat sheets or open end tanks with a minimum of 30" dia and up to 10' long. For polishing the inside diameters of open end cylindrical tanks there is an ID tank grinder and polisher. A companion machine to the seam and ID grinders is a tank head grinder and polisher. Hi-Lite Polishing Machine Co., Dept. F7-49, Route 2, Sheboygan, Wis., or —
Circle Inform-A-Gram No. A91.

Extended Type Outer Support Bushings have been produced for Models KMB and KMC Kempsmith horizontal milling machines by Donley Products, Inc., 11106 Avon Ave., Cleveland 15. In addition, the company makes taper sizes, lengths, arbor and body diameters to fit both extended and built-in applications of Cincinnati, Milwaukee, Sundstrand and Brown & Sharpe horizontal milling machines. The new bushings are reported to increase speeds and feeds up to 200% with minimized bushing wear, tool breakage, arbor wear,



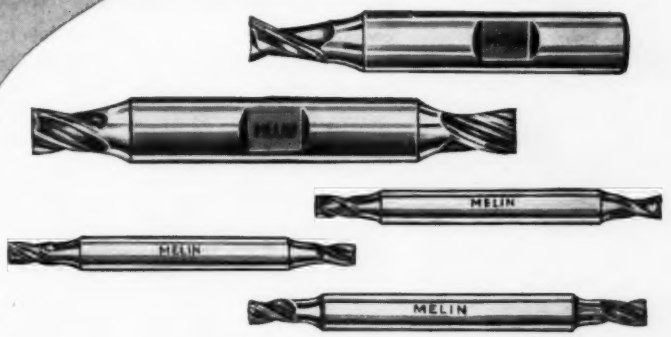
scoring and chatter. Photo shows extended type and built-in type milling machine bushings.
Circle Inform-A-Gram No. A92.

MELIN

STUB LENGTH END MILLS
with flutes shorter than regular

Offer GREATER STRENGTH...*

TWO, THREE AND FOUR FLUTE



...★ *Plus an Exclusive*... In addition to manufacturing a *complete* line of End Mills, the Melin Tool Company makes several standard *Stub Length Mills* exclusive of other tool manufacturers.

The new Melin Tool Catalog No. 54-C lists the specifications on these *all inclusive* Stub Length Tools... and... they offer greater strength and less breakage. Write for your catalog... today.

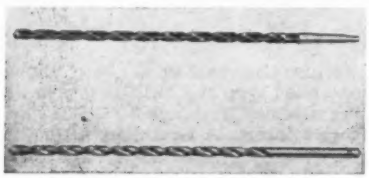
Representatives in Principal Cities

MELIN TOOL COMPANY, INC.

3371 West 140th Street
Cleveland 11, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 249

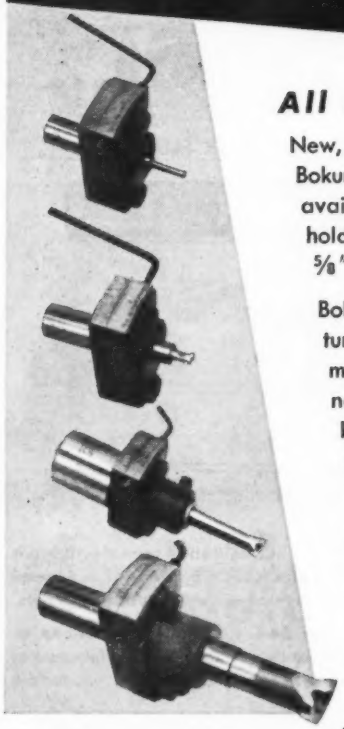
A Complete Line of Extra Length Drills has been announced by Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. These high speed steel drills are designed for operations were inaccesibility is a problem, or for extremely deep holes. They will perform under a wide range of operating conditions and materials. Diameters range from No. 52 wire gauge to 1½" and overall lengths to 23½".
Circle Inform-A-Gram No. A93.



Repair Defects in Castings, Modify Patterns, and Cement Gages with an epoxy resin compound containing powdered aluminum. Metalset A2 is reported to be easier to use, cheaper and more efficient than other methods. The photo shows the left side of a pattern that has been built up with Metalset to increase wall thickness of the final casting. The material has been applied to the cleaned surface and smoothed to conform with the surrounding metal of the pattern. Smooth-On Mfg. Co., Jersey City, N. J., or —
Circle Inform-A-Gram No. A94.

Now! Immediate Delivery

ON BOKUM SWING BORING TOOL HOLDERS . . . *Complete Line*



All Sizes for All Machines

New, precision-engineered Tool Holders for Bokum Boring Tools are now immediately available from stock in eight models . . . with holder shank diameters ranging in size from ⅝" to 1¾".

Bokum-designed for use on screw machines, turret lathes and multiple spindle automatics, these improved tool holders eliminate many secondary reaming operations, keep set-up time to a minimum, maintain rigid support, hold concentricity and accuracy in boring operations. They're made of alloy steel, specially heat treated and they're adjustable to boring positions of .001".

Write for Supplement No. 1, Catalog 483-E or, better yet . . .

PLACE YOUR ORDER TODAY!

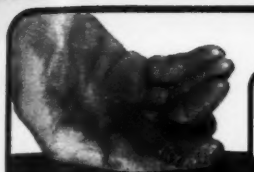
TRADE MARK REG. U. S. PAT. OFF.

BOKUM TOOL CO. INC. 14775 Wildemere Ave. Detroit 38, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 250

A Newly Designed Bench Shear and Rod Cutter has been introduced by The Progressive Tool and Mfg. Co., 859 Foxon Rd., East Haven, Conn. Kar-ry No. 1 model shears sheet metal up to 3/32" thick in any length and width and cuts rods up to 5/16" dia. A larger model, Kar-ry No. 2, shears sheet metal up to 3/16" thick and cuts round rods up to ½" dia. Both can be used for production purposes as well as for making samples and templates in tool and die work.
Circle Inform-A-Gram No. A95.

Designed for 1500 Psi Pressure is a new hydraulic 4-way valve. An oil pressure feature permits automatic operation when the oil pilot valve is controlled mechanically. Model 5835 requires oil pilot lines to each end of valve for remote operation from an oil pilot valve. The valve is offered in seven sizes. Rivett, Inc., Brighton 35, Boston, or —
Circle Inform-A-Gram No. A96.



You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

IN 11 SIZES No. 6 to 1" N.C. in all S. A. E. sizes.

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work now—save money too!

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Model P-5 Optical Comparator

A tried and true instrument for optical inspection at a reasonable price. Send for literature.

PORTMAN INSTRUMENT CO., NEW ROCHELLE, N. Y.

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Buy safe "SHUR-GRIP" drop forged HANDLES

Designed to hold 3 to 6 lb. lead hammer heads more firmly — will not slip — keeps hammer head in shape longer — makes remolding easier, quicker, surer, less expensive.

Write for circular and prices

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48 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 2513

AUTOMATIC FEEDER FOR HEAVY GAUGE SHEET STEEL

A new machine has been developed recently for feeding heavy gauge sheet steel to such processing equipment as punch presses, shot blasters, roll formers, slitters, and trimmers. The machine handles sheet aproximately ⅛" thick whereas present standard machines are designed for thicknesses in the 1/32" range.

Feeders may be constructed for sheets of any reasonable size; the one illustrated handles sheets 42" wide by 120" long. Major advantage of this equipment, developed by the Dexter Folder Company, is that it eliminates handling of individual sheets weighing in the neighborhood of 75 lbs each, depending upon size and thickness.

In operation, stacks of sheet are brought to the feeder and deposited on its loading platform (not shown) by fork truck. Vacuum cups then reach down, grip the top sheet and lift it (as much as 18") to permanent magnets which hold the sheet in standby position.

The equipment being fed triggers the feeder when it is ready, and a pusher shoves the sheet forward into feed rollers which deliver it to a short conveyor section leading directly to the processing machine. When the sheet passes a pre-determined point in the production operation, the suction cups of the feeder reach down and lift the next sheet into standby position.

Suction cups and magnets may be positioned for different size sheet by means of hand wheels provided for the purpose. The speed of the feeder is regulated according to the speed of the production operation; the feeder shown delivers 6 sheets/min.

presenting...the NEW

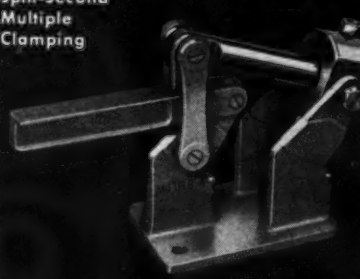
DE-STA-CO

Clamp-omatic

AIR OPERATED

TOGGLE CLAMP

for Positive Split-Second Multiple Clamping



MODEL **858**

18¼" long
8" high
4" wide

- EXTRA HEAVY DUTY
- HARDENED BUSHINGS at all pivot points
- COMPONENTS EASILY REPLACED due to screw-type construction
- FORGED STEEL COMPONENTS

Holding Pressure to 2,000 Pounds with Normal Air Line Pressure of 90 Pounds. Weight 16 lbs.

Write today for Literature on this new DE-STA-CO CLAMP-OMATIC, Model 858, as well as Models 810-U and 810-S.

DE-STA-CO **DETROIT STAMPING COMPANY**

WORLD'S FIRST LINE OF TOGGLE CLAMPS

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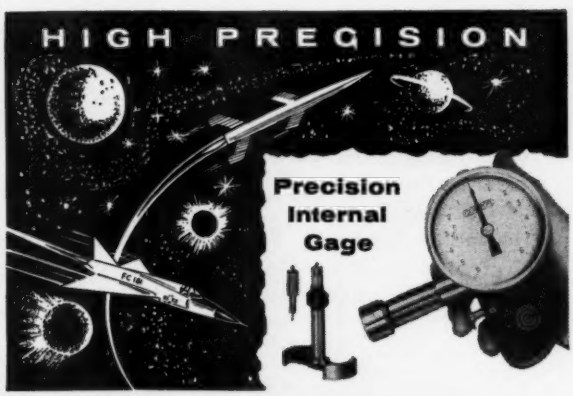
HIGH PRECISION



COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from ⅛" to 10" dia.

UNIQUE ADVANTAGES

- Indicates actual size, a fixed — not passing — reading.
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- Positive 2-point gaging — automatic centering.
- Assured accuracy regardless of who operates it.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Will gage work in the machine.
- A shop tool for all-day every day use.

COMTORPLUG'S Comparator Principle and automatic features give the precision to meet tolerances in tenths . . . unencumbered by the need for air hose, electronic gear, heavy base or training programs. At machine, bench or lab, Comtorplug gives the high precision required in jet propulsion equipment, farm machinery, automotive transmission, household equipment and other mass-precision projects. Users call it "THE EASIEST way to POSITIVE PRECISION."

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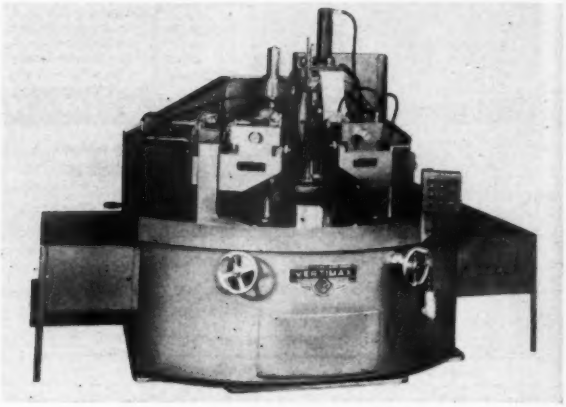


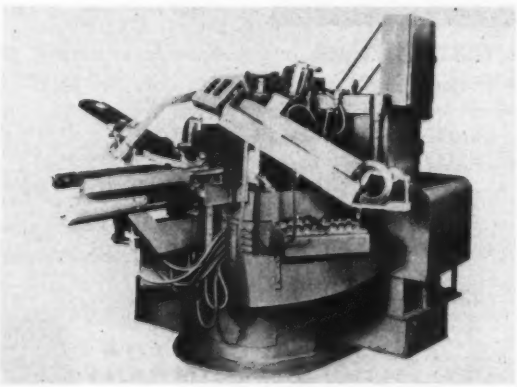
Vertimax with guards removed illustrating twin tool slides.

VERTICAL CHUCKING LATHE FEATURES TWIN TOOL SLIDES

AN ENTIRELY NEW CONCEPT in the field of vertical chucking machines is found in the Cleveland Vertimax, an automatic vertical production lathe.

The machine has outstanding rigidity, the secret for which is the elimination of cantilever or over-hung type support for the tool slides. The entire design of this machine is based on tool slides supported at both ends. This design provides maximum rigidity against cutting forces, against extremely heavy and interrupted cuts, and provides an ingenious method of adjusting tool position by means of calibrated eccentrics.

Although primarily intended for repetitive production runs, the Vertimax, developed by Cleveland Hobbing Machine Co., is versatile and economical for small quantities, since set-up, changeover, and tool change are quick and convenient. The tool slides, manufactured from high-grade steel, hardened, ground, and automatically lubricated, can be swiveled from below horizontal to beyond the vertical position, making possible — besides normal turning and boring operations — the simultaneous machining of two internal, two external, or an internal and external taper. Their calibrated eccentric adjustment enables setting to be quickly made and noted for future repeats.



Vertimax with typical automation for differential ring gear.

The tool slides are cycled automatically by hydraulic controls which employ a differential feed system. Being thus hydraulically locked they are ideal for interrupted cutting and other difficult machining operations. The differential system also senses unusual load conditions such as excess stock or broken tools and through the use of a pressure sensitive control will automatically return the tool slides.

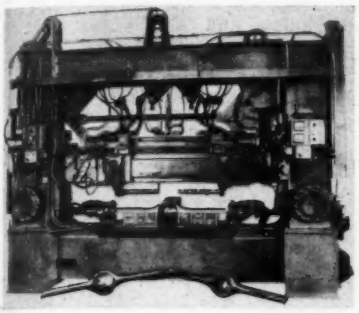
Automatic, rapid tool approach to cutting position and automatic tool relief for the return stroke are standard features. The tool slides can be operated simultaneously, or in any desired sequence.

Depth of feed and slide travel are controlled by a mechanical, positive stop providing repeat accuracy; or optional automatic size control (compensation for tool wear) can be furnished by single control substitution.

Vertimax machines can be built with complete automation, with complete automatic loading and unloading, with semi-automatic loading and unloading, with automatic size control, and with hydraulic profiling. end

NEW WELDER FEATURES SIMULTANEOUS WELDING AND FLUX RECOVERY

An automatic submerged arc welder, featuring simultaneous welding with four platen-mounted heads, has been designed and built by Swift-Ohio Corporation, primarily for welding transverse seams in automotive rear axle housings. However, its techniques and tooling are adaptable to a variety of high production submerged arc welding applications.



In use, two stampings are simultaneously clamped in the machine. An upper platen securely clamps the housing halves during the welding operation. It is suspended from the crown by toggle linkage, and moves through side-mounted guides.

Upon completion of the welds, an automatic ejector loosens the completed housing from the fixture, permitting its ready removal.

Provision is made for excess flux recovery, which returns the unused flux by screw and bucket conveyors to flux bins on the machine crown.

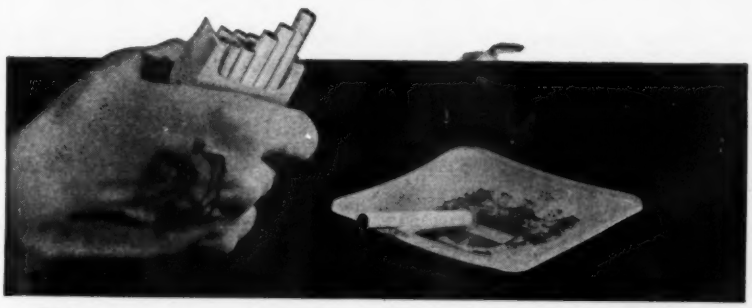
TRANSFER MACHINE DESIGNED TO AVOID VERTICAL MACHINING

A new segmented transfer machine that utilizes workpiece orienting devices to avoid vertical machining units and provide maximum accessibility of tools has been designed and built with 53 stations. It drills, spotfaces, chamfers, reams, line reams, taps, mills and bores cast iron sliding gear transmission cases at a net production rate of 80 cases/hr. The cases are turned 90° at station No. 13 and tipped up 90° at station No. 38.

Each of the 13 segments of the hydraulically operated, electrically controlled machine is made up of horizontal 2-way units utilizing Snyder Tool & Engineering Co. standard way-type and self-contained designs with hardened and ground ways. Separate pushbutton controls and panels are provided for each segment, thus permitting independent part clamping, machining and unclamping for setup and repair operations. To simplify tool changes, the spindles are arranged for preset cutting tools.

Three in-process gaging devices that probe drilled holes to check for through-drilling before tapping are included on the machine.

The part is specifically located for machining and transfer on faces that have been determined as not subject to future design changes. This feature prolongs the design life of the machine, and simplifies machine design alterations that may be required for anticipated part changes.



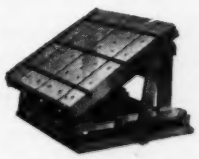
Half the Cost of "a Pack a Day"

CUTS TOOLROOM COSTS THE *Robbins* WAY

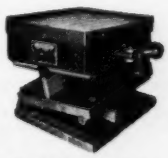
Robbins angular tooling equipment often pays for itself the first few times you use it . . . but let's be conservative. Let's talk about writing off the cost over ten years. (About half the useful life of a "Magna-Sine!") Written off in this manner, the Model A-5 Magna-Sine illustrated represents an investment of around twelve cents a day!

This equipment saves dollars of valuable toolroom time on every job. Set-ups that require *hours* by other methods take just *minutes* the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

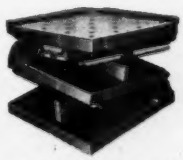
This simple, fast, sure method sets up any angle, single or compound, right or left hand, without V-blocks, angle plates or complicated "build-ups." Complete range of models and sizes puts Robbins precision equipment within the reach of every shop. Write now for literature.



HEAVY DUTY SINE PLATE FOR MACHINING



"MAGNA-SINE" WITH MAGNETIC TABLE



FOR INSPECTION AND LIGHT MACHINING

OMER E. *Robbins* COMPANY

24800 PLYMOUTH ROAD DEPT. C DETROIT 39, MICH.

Also manufacturers of special machinery, automatic assembly machinery. 5937

CIRCLE INFORM-A-GRAM KEY NO. 253

CUMULATIVE EDITORIAL INDEX FOR 1957 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects on which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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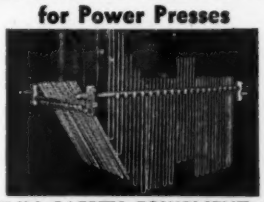

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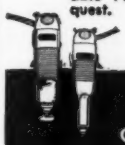

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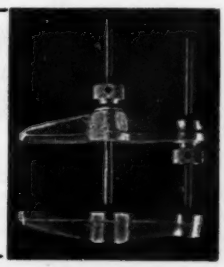

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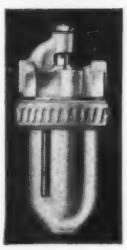

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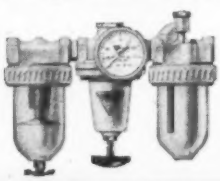

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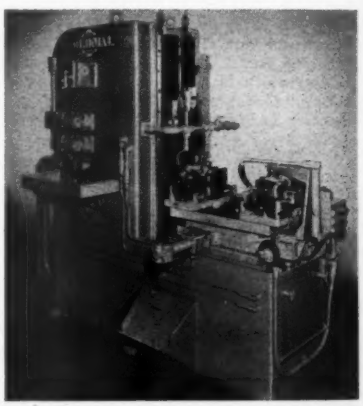

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